HOME IMPROVEMENT CONTEST—500 PRIZES PAGE 161

POPULAR SCIENCE

SEPTEMBER · 35c *Monthly*

1961 Pontiac Tempest's HOT NEW 4-CYLINDER ENGINE...

...and look where they've put the transmission!

FOLD OUT HERE

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For complete details, see p. 53

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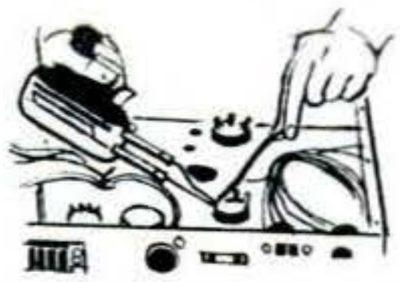

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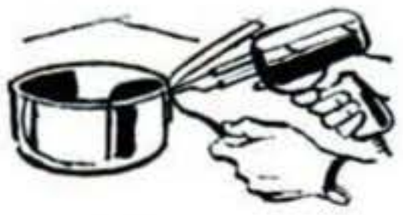

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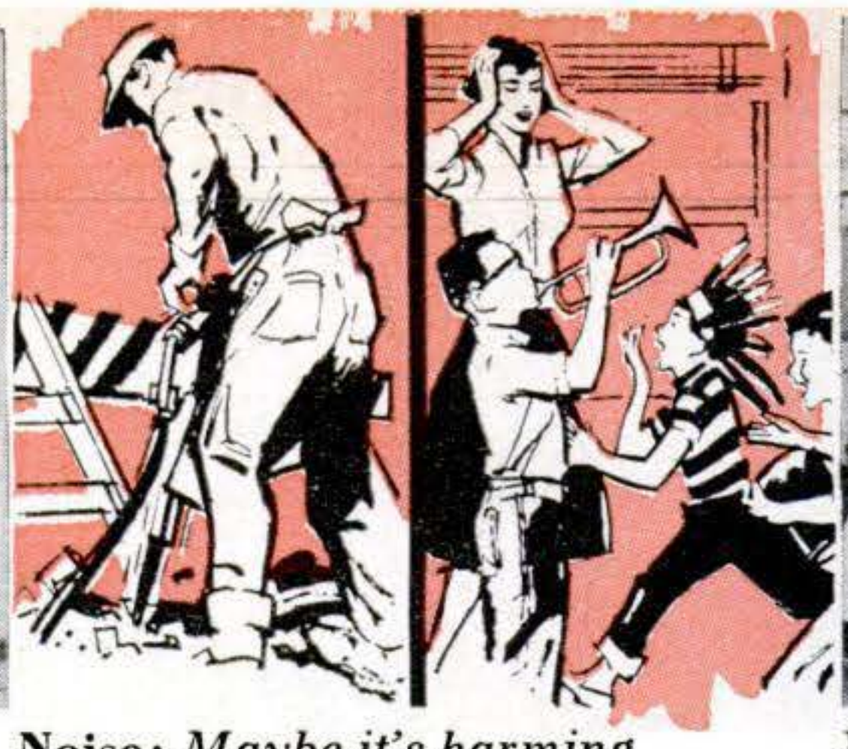

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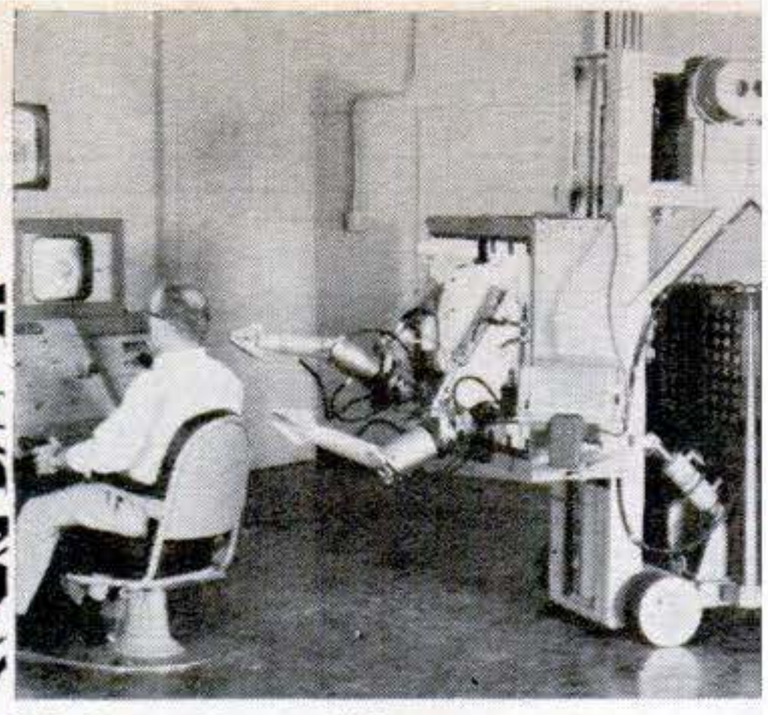

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Founded in 1872 *Vol. 177 No. 3* *Mechanics and Handicraft* REG. U. S. PAT. OFF.

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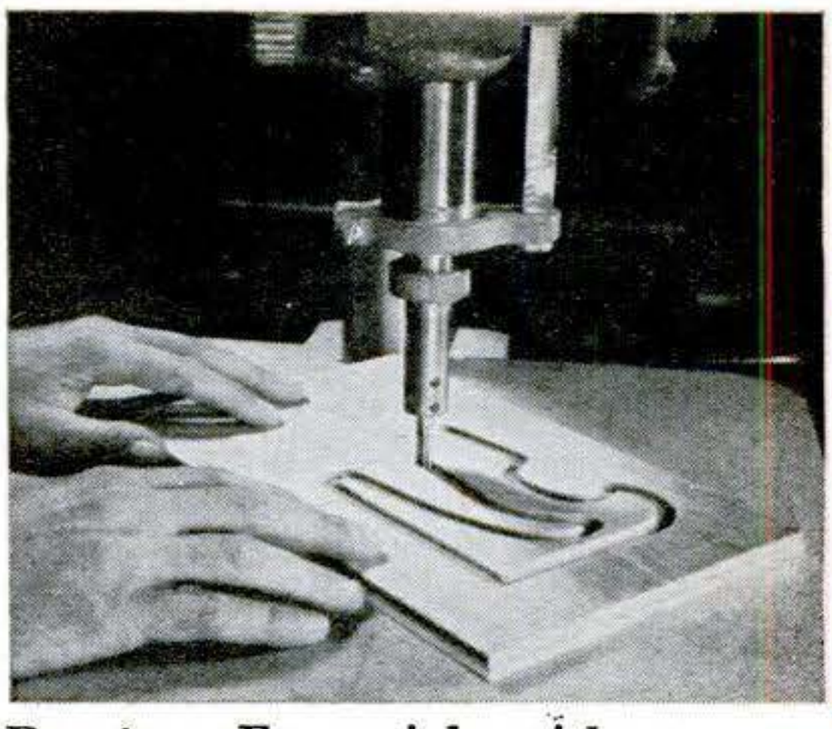

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PS Readers TALK BACK

Those Early Sports Cars

"THE World's First Sports Car" [June] brought back memories of a little car owned around 1905 by a friend of mine.

It was built in Waltham, Mass., I think by the Waltham Watch Co., and it kicked up a lot of dust around here. It was not a midget but was quite a car for those days—carried two people very comfortably and had a four-hp. engine driving one rear wheel, by chain, I believe. There was some sort of clutch worked from the driver's seat.

The buckboard seat was mounted on wood slats. The wheels and tires were about like motorcycle wheels in size. Steering was by a tiller handle on which was mounted a large bicycle bell.

I surely wish I had a picture of it as it flew around our streets—it would make any antiquer drool.

WALTER W. FRY, Belvidere, Ill.

Can anyone identify this early bird?

. . . WHEN a boy of 11, I moved from New York City to my uncle's farm in New Jersey. In the barn, the prior owners had left just such a conveyance as your article pictured. My cousin and I were permitted to use it only on Sundays, after our chores were done. We only ran up the back road for a half-mile and back again. But what fun!

I'm sure lots of your readers would be interested in building the Flyer for their children. Is there anywhere one might get plans and necessary parts?

HENRY SIMEONE, Los Angeles.

We know of no commercial firm that sells plans or parts. You might write to Dave Uihlein, Banner Welder, Inc., 6820 N. 43rd St., Milwaukee; and Robert Baier, Milltown, N. J. It's a long shot, but they might have parts to spare, and possibly plans, too.

. . . I'D LIKE to add one more name to the list of enviable owners of a Smith Flyer: Elliott Neuberg. Mr. Neuberg's car is in excellent condition—even carries the original tires.

RACHEL NEUBERG, Chicago.

. . . ROBERT GORMAN'S article really hit the spot. I am presently converting an Auto Red Bug to gasoline power—mainly because the electric motor was missing when I acquired the car. I was able to pick up a set of needed 1.50-by-20 tires, but I'm still on the lookout for a fifth wheel. So far, my antique has given me a lot of enjoyment.

P. H. CHOATE, Falmouth, Mass.

Anybody Need a Tack?

THE other day I needed some carpenter tacks when the hardware store was closed. I went to the nearest telephone pole. There are scads of them there, waiting to be picked off. After November, there'll be hundreds!

GERALD SCHLISSER, Arverne, N. Y.

Sparks from the Spark-Plug Story

AFTER reading "The Truth About Spark Plugs" [June], I went out and checked the polarity of the coil in my Ford. I pulled the cap off one plug and noted which way the spark jumped. It went from lead to plug; the article said this was wrong. When I looked at the coil, the terminals were clearly marked BAT and DIST. I looked at the wires and they were connected correctly. I then remembered that when I had my new battery installed, the man grounded the positive side to the block.

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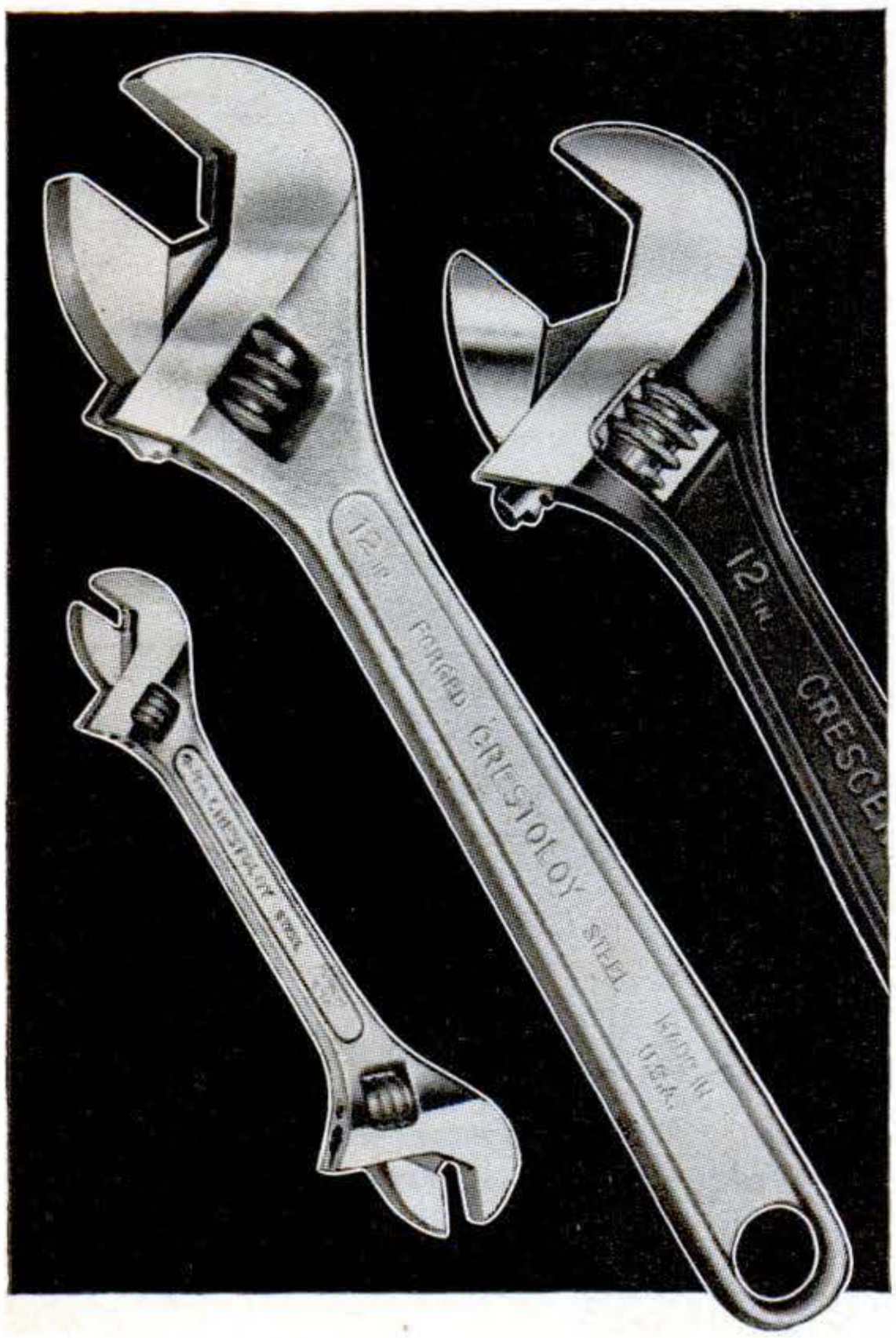

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I am wondering if this procedure is one peculiar to my '49 car, or to all Fords?

A.T. BARNARD, Palo Alto, Calif.

Polarity should be negative at the plug terminal regardless of how the battery is grounded. Ford cars through '55 grounded the positive terminal. If your coil is a replacement, not original equipment, the markings may be incorrect. If the lead-pencil test described in the article indicates that the spark-plug terminal is positive, reverse the coil primary leads.

. . . I OWN a '59 Caddy Eldorado. It has a 10½:1 compression ratio, but always lacked the power I expected and pinged with the slightest effort. Numerous agency trips netted me the same answer each time: The ping could be

eliminated by using the highest test gas. My gas mileage was 11 per gallon!

After 16,000 miles, I tried surface-discharge plugs. I had them tested, along with new old-type plugs recommended for my car. The tester couldn't go high enough to make the surface-discharge plugs fail, impressing even the mechanic. Installed, results were gratifying. Practically no ping in passing or hill climbing. As for fuel, the last check showed 16.3 m.p.g. The plugs have been in for 2,000 miles now. The car performs beautifully although I do notice it's a bit harder to start when cold. This I can put up with!

J. B. TAYLOR, Upper Black Eddy, Pa.

. . . I SURE don't agree with you on the surface-type plug. I've been driving for 40 years and the last 10 I had trouble getting more than 6,000-7,000 miles out of a set of plugs, or 10,000 out of points and condensers.

Last winter I put in a set of fuel igniters and since then I get about 2½ more miles to the gallon on premium

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and about two miles more on regular gas. I changed points in December, and 18,000 miles later they're still not burned or pitted. My starts are better, too.

I was a mechanic and pilot in the Navy for 20 years and, to me, the figures on my tally sheet are proof of performance.

D. E. BUNGER, Jackson, Miss.

. . . AUTHOR Hubert Luckett implies—but does not say positively—that as long as a spark plug fires, it makes no difference whether the spark is long or short, strong or weak; its efficiency will be the same. It is a well-known fact that a plug with a weak spark makes starting, especially with a cool or cold motor, quite difficult.

RAY H. LEITH, Van Duyne, Wis.

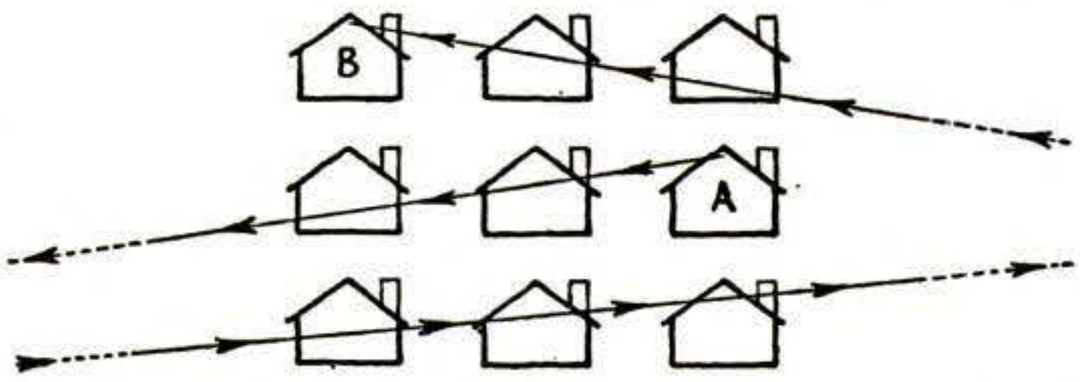
The article said positively "Once [the plug] starts the fuel-air mixture burning . . . it has no effect on how much power the burning fuel delivers."

A weak spark may fail to ignite the fuel, and you have "misfiring"—the engine will be hard to start and there'll be loss of power. But if the "weak" spark starts the fuel burning, the cylinder will deliver just as much power as if it had been ignited by a "strong" spark.

Puzzlers Puzzle 'Em Out

THAT straight-line puzzle, [May]: So Sam Loyd makes delivery to every house in four straight moves with the remark that "Nobody said you couldn't go past the houses."

Well, nobody said that you couldn't



make delivery in attic or cellar, either! Answer in three lines herewith.

J. S. ZIMMERMAN JR., Baltimore.

. . . I HAVE always found your magazine very interesting—until I read those idiotic "PS Puzzlers." For example, the Logical (?) Puzzle in April:

You say the painter tried to get the carpenter to work for him, but *was told* the carpenter was out working for the plumber (clue 1). In your answer, you say that the painter couldn't be Fuller,

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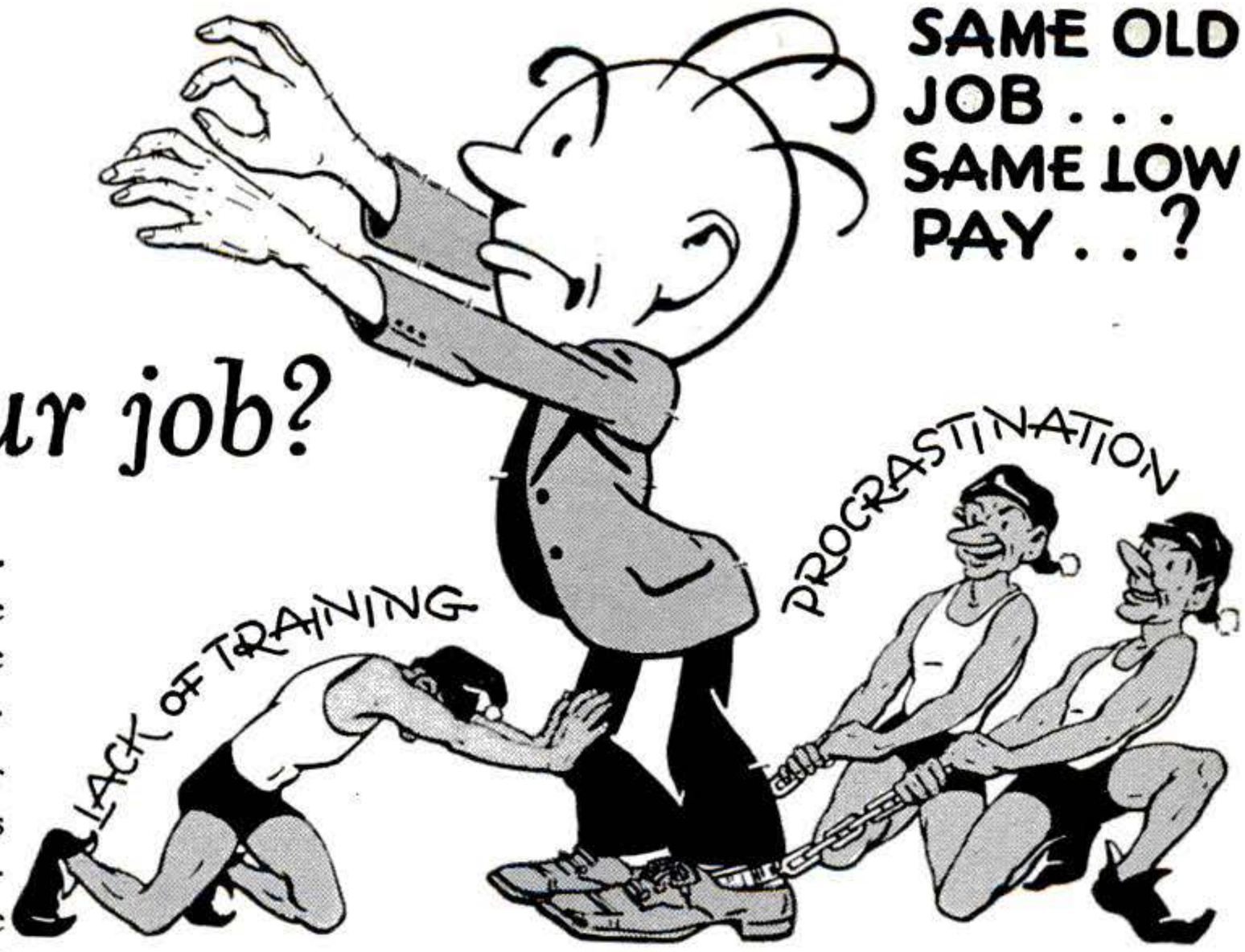
Are You "STANDING STILL" *on your job?*



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because by clue 1 the painter knows both the carpenter and the plumber. Who says so? You certainly don't. There is no reason to believe that he ever heard of the plumber. And the fact that the painter called up the carpenter proves only that he knew *of* him.

JOAN MCCORMICK, Victoria, B. C.

. . . YOUR solution to the April POTM while technically correct is naive, to say the least. You based your solution on the fact that only two sets of numbers would produce the proper product (225) when, in fact, a large number of sets will do so. How about trying 22½, 20, and ½?

The question "Are you the eldest?" would appear much more logical than with your choice of numbers. Whoever heard of a census taker who would express any doubt concerning which of the ages—25 or 3—would apply to the person he was questioning?

E. F. MERRIAM, Albuquerque, N. M.

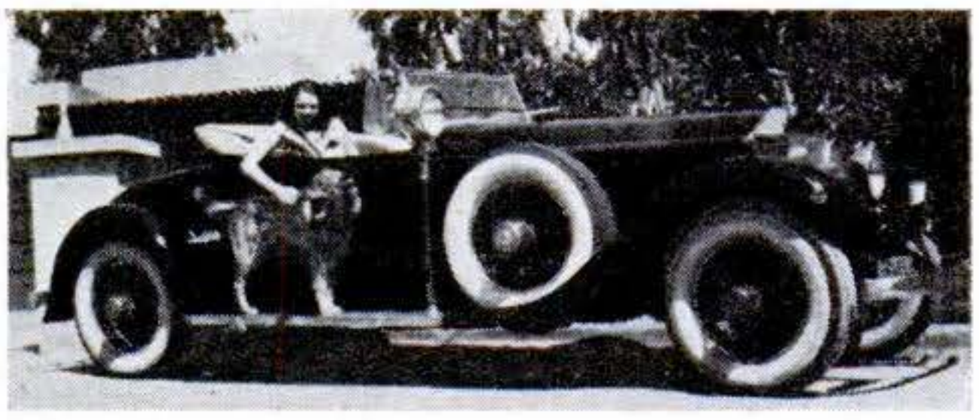
. . . YOUR puzzle about the mercury electrical switches that wouldn't work because they were installed upside down [April] amused me. Even when installed right side up, these switches can sometimes fail to operate.

If the switches aren't plumb, due to uneven plaster, tilted switchbox, etc., either the lights will be on and can't be turned off, or they'll be off and can't be turned on. Putting washers under one of the mounting screws will bring the switch into plumb and allow the mercury tube to operate properly.

A. P. MULCAHY, Nanaimo, B. C.

Art in Metal

THE Rolls Royce piece ["World's Fussiest Car Factory," May] inspires me to tell you of three thoroughbreds I owned



some years ago. A roadster, convertible, and sport sedan, each of these Rolls was a beautiful creation of art in metal, and performed like a race horse.

Perhaps I'm old-fashioned, but today's Rolls looks heavier and more clumsy or

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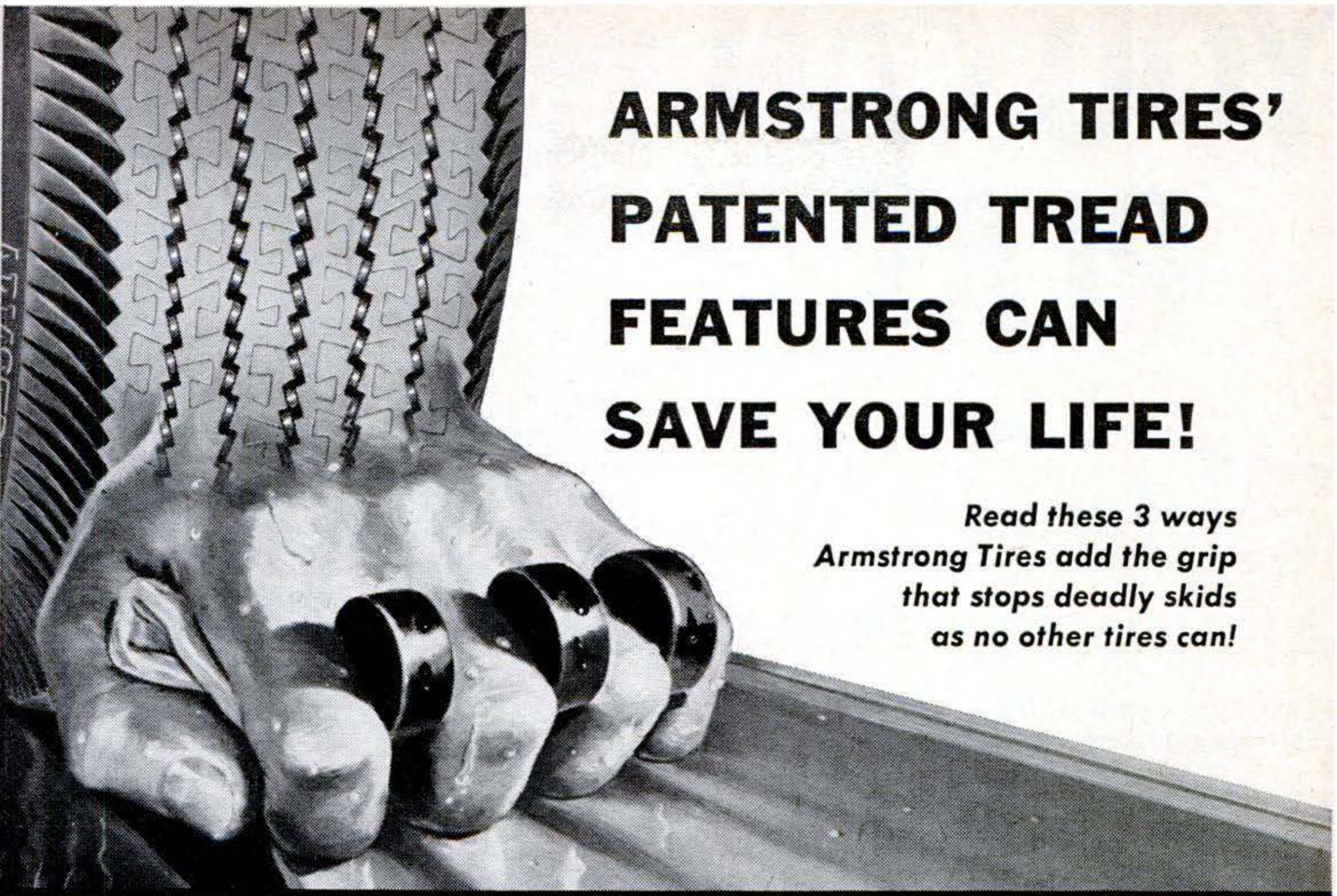

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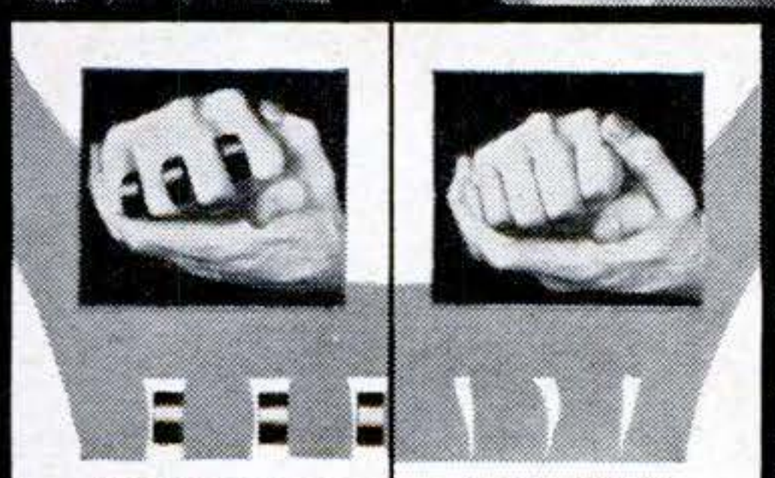
Read these 3 ways Armstrong Tires add the grip that stops deadly skids as no other tires can!

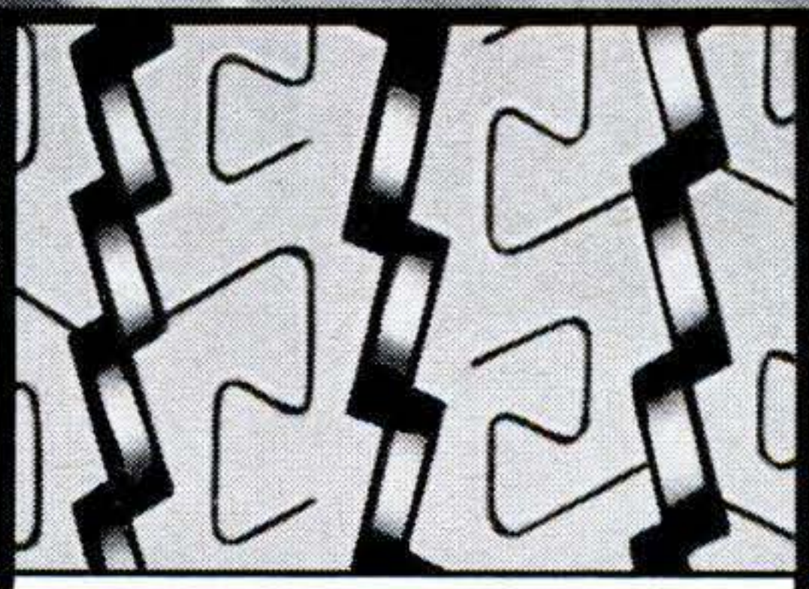


Famous "Ounce of Prevention"

PATENTED SAFETY DISCS KEEP TIRE'S GRIPPING EDGES OPEN

Just as Safety Discs in fist (above left) keep fingers apart, so over 1000 Safety Discs in each Armstrong Tire keep tread's gripping edges apart, always ready to grip – no matter how hard you brake!

But fingers of fist *without* discs (above right) *can* squeeze shut. That's why ordinary tires, lacking Safety Discs, can squeeze smooth and slippery under braking pressure – *and you skid.*



Grip in all directions!

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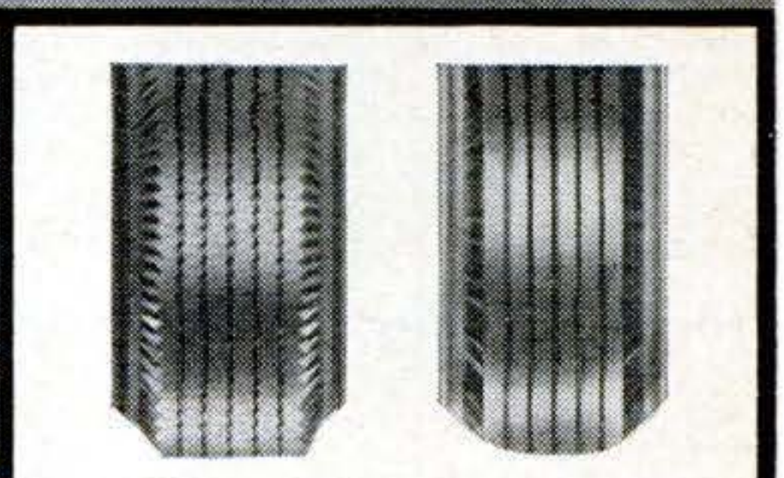
In winter, interlocking sipes' "wiper" action keeps you safer on wet roads, gives you snow tire "go" on packed ice and snow.



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Armstrong Rubber Company, Home Office, West Haven, Conn.

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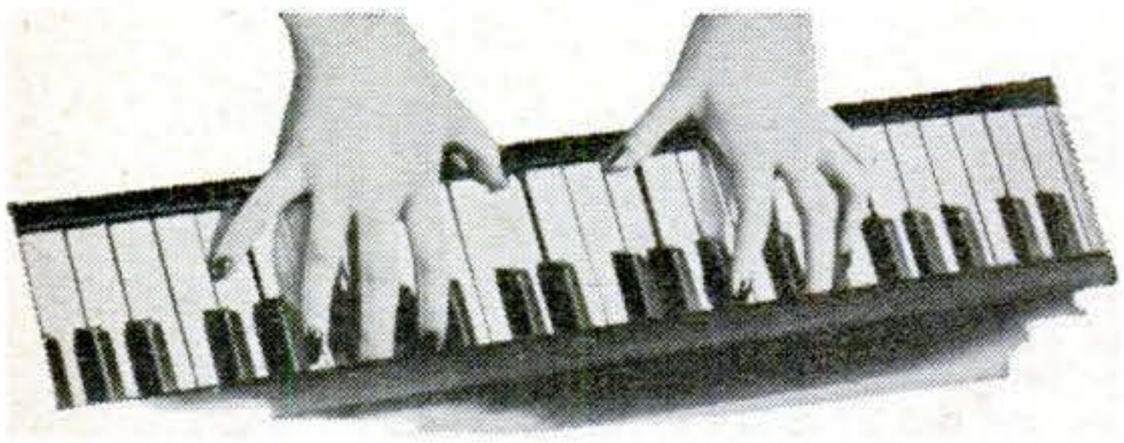

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boxy than my sleek-lined older vintage cars. But no doubt the company builds the style the public demands.

T. C. QUAYLE, Veneta, Ore.

Challenge to RWD-Car Drivers

How anyone could prove the superiority of rear-wheel drive using a toy car ["PS Readers Talk Back," June] is beyond me!

I have a DKW with front-wheel drive and I'd like to see a car with rear-wheel drive (barring the Jeep) that can match it in snow, mud, or ice. Rear-wheel drive tends to spin a car if one wheel happens to spin on ice. FWD cars may spin their wheels, but they won't spin the car. One can even stomp on the gas and not change the direction of the car.

ARDEN JONES, Berrien Springs, Mich.

. . . I'LL challenge any rear-wheel-driven car up any icy hill or around any wet curve with my '53 11CV Citroen or

my '59 ID-19. Without chains, I've climbed hills that U. S. rear-wheel-drive cars couldn't climb with them.

If a small manufacturer like Citroen can solve the problems of U joints, Detroit should be ashamed to give us the same engineering warmed over every year. Let Pontiac of wide-tread acclaim put out 333 horsepower with FWD and air-oil suspension, plus the design underneath the car that is possible with FWD, and Ford and Chrysler will have sold their last car.

CLAUDE L. RIE, Bronxville, N. Y.

They Dote on Trucks

I ENJOYED the factual story about turnpike trains [April]. To meet demands of truckers, White, International, Brockway, Mack, and Autocar have introduced "double bottoms." All use the 335-hp. Cummins diesel engine.

The 12-speed transmission (made by Spicer) is a preselect, air-actuated, semi-automatic one. The HI and LO range is

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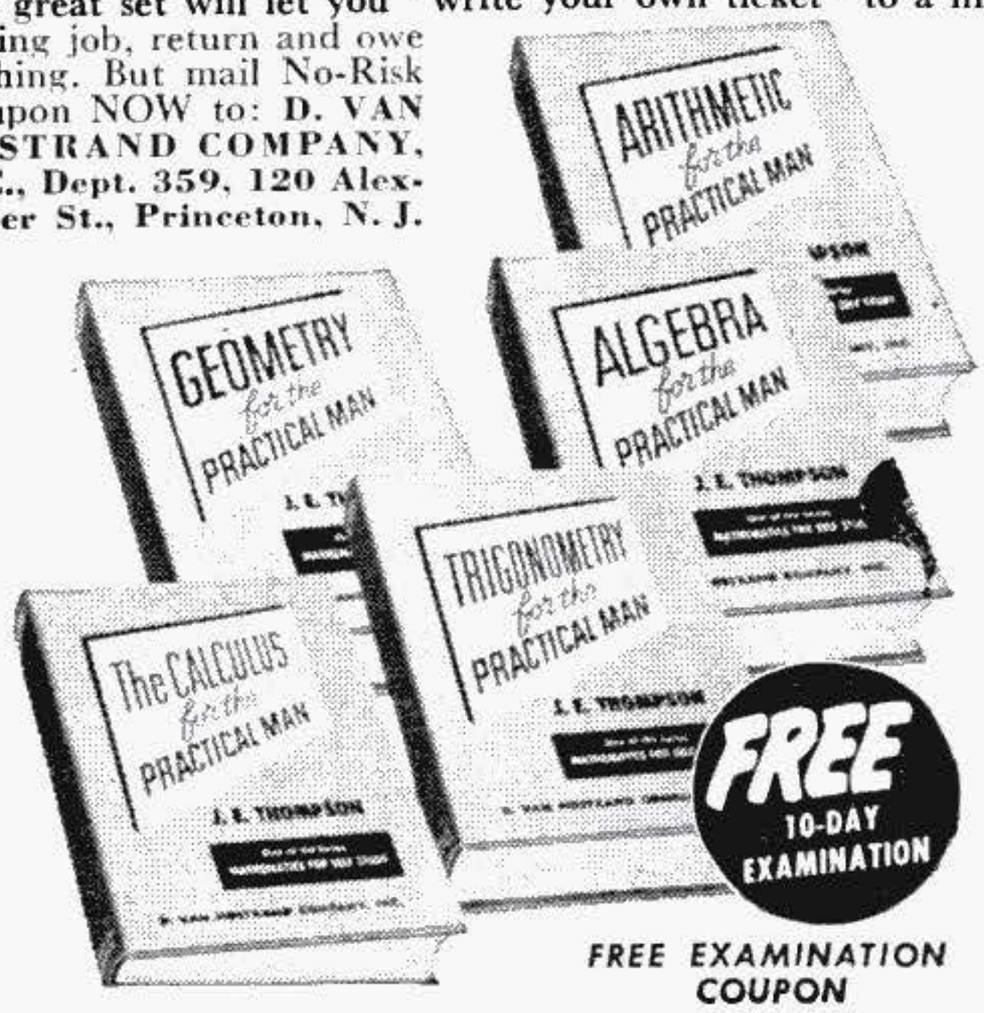

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selected by the range button: pulled up for HI and pushed down for LO range. It's never pushed down below a road speed of 20 m.p.h.

The splitter is used for selecting the individual speed ratios. Turning it counterclockwise preselects the even-numbered gears; turning it clockwise, the odd-numbered gears. The transmission stick must be brought to neutral position to complete the shift. The stick weaves a small "h" pattern. The driver runs through the pattern twice to attain 12 speeds, once in LO, then in HI range.

JAMES TABATA, Cleveland.

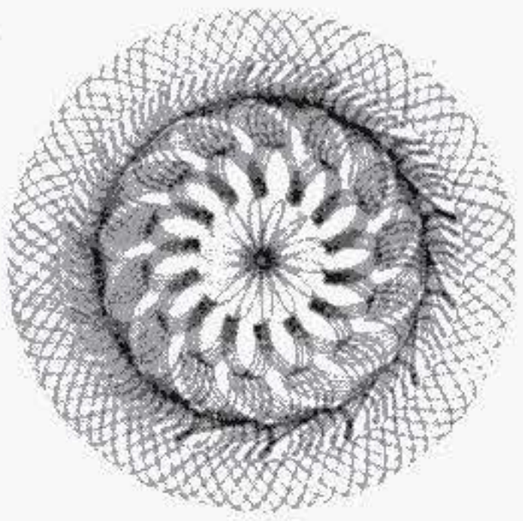
. . . HAS the letter writer [May] who objects to trucks and articles about them ever seen a train stop to help someone in trouble? Truckers are the most courteous drivers on the road. If a car skids into a ditch, runs out of gas, or just conks out on the road, it's the trucker who stops.

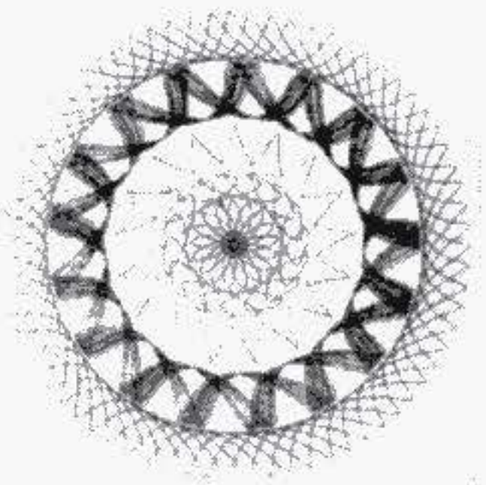
If the trucks ever stopped rolling, we'd go without a good many things and in the end we'd be a mighty hungry lot of people. Who ever heard of a train delivering to a store? And how would that guy ever get gas for his private car to ride on his private roads?

D. M. HARRIS, Findlay, Ohio.

A Rose Is a Rose Is a Rose Engine?

TELL the gentleman who wrote you a letter about nomenclature [May] to forget it. We don't care if it is a rose en-





gine or a geometric pen, it works. When you told us how to build "the thing" last December, we did so, and produced the drawings herewith.

GLENN HANNA, Kokomo, Ind.

Turning a Hexagon

I'VE just finished reading about Lloyd McWilliams' very novel method of turning a small hexagon in the four-jaw chuck ["An Easy Way to Shape a Hexagon," May]. His solution to this problem was

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good, and I'm sure the finished work, with its concentric highlights, was quite attractive.

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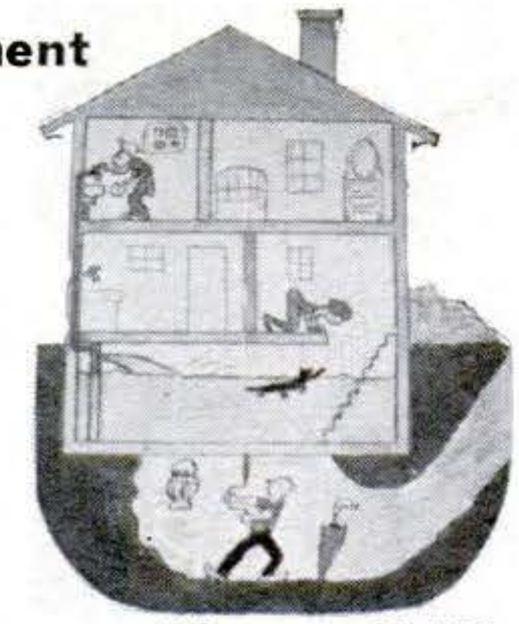
M-G Tool, Riverside, Calif.

Drying Out a Basement



THIS short cut to draining a flooded basement might have interested David X. Manners, author of the piece on waterproofing ["Solved: The Wet-Basement Problem," April].

HI SIBLEY, Nuevo, Calif.

. . . MAY I sound a warning on your basement waterproofing article? When preparing the surface to be coated, do *not* use a torch to dry the wet cement. Moisture below the surface can create steam and cause injury to the operator by explosion, throwing concrete in all directions with tremendous force. I speak from experience!

ALBERT BALLA, Gould City, Mich.

Appeal of the Wild

I WAS jolted by your article "America's Most Misunderstood Snake" [April]. It was real news to me that the gopher snake is not dangerous.

Perhaps Mr. Griswold could do some interesting pieces on the hawk and fox, too—while there still are some.

LARRY RAMSBY, Haifa, Israel.

Dwell Meter Whets His Appetite

THE author of "How to Make a Transistor Dwell Meter" [May] did a swell job. I made one from his clear description and it works fine. Now could he show us how to make a tachometer, working from the same engine contacts?

ARTHUR BEAUMONT, Philadelphia.

The Pitch on Roofing

WE HAVE just read "Which Roofing Should You Buy?" [June]. Our congratulations to the men of your staff who prepared it. The article is complete, concise, and correct. You are providing a valuable service for your readers in the presentation of such factual information.

WARREN NEALE, Product Mgr.
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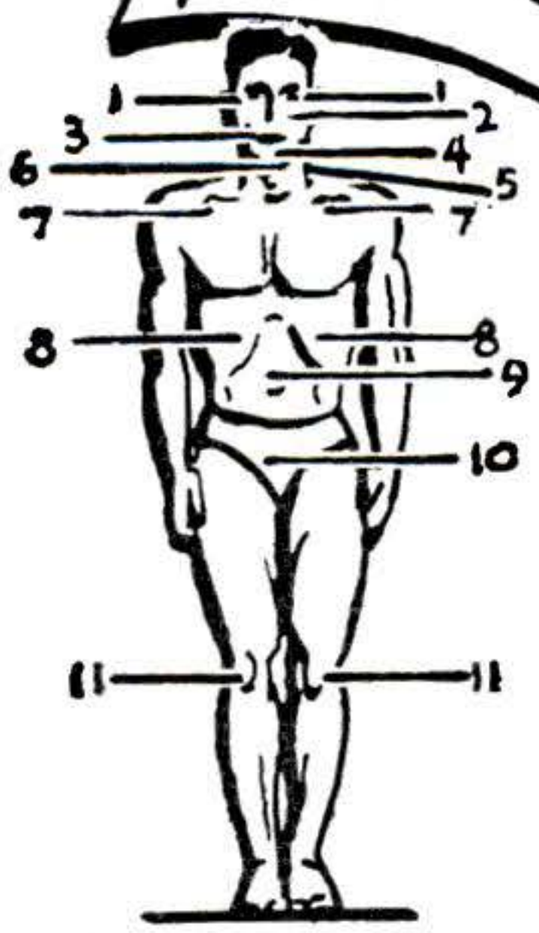

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PS Puzzlers By Joan Steen

Teasers for trained minds to tackle . . . Answers on page 256

Who Is the Strongest of Them All?

BRUTE force will not solve this problem. Clear, cool logic will:

Bill, Hank, Joe, and Tom were amusing themselves one day by playing tug-of-war. Although it was hard, Hank could just outpull Bill and Joe together. Hank and Bill could just hold Tom and Joe, neither pair being able to budge the other. However if Bill and Joe changed places, then Tom and Bill won easily.

Who was the strongest, the next strongest, and so on?

A 12-INCH long-playing record has grooves that start a quarter-inch from the outer edge and finish with a last groove having a five-inch diameter. Assuming there are 120 grooves to the inch, how far does the needle travel in playing the entire record?

We'll nudge your memory on this one and remind you that $C=2\pi r$ and $A=\pi r^2$ . . . if you think it'll help.

"IT'S a simple game," the man in the checked suit said at the fair. "I have three cards here. One is red on both sides. One is white on both sides. And the third is red on one side and white on the other. I'm going to mix them up in a hat and ask for a volunteer to pick one out without looking at it."

A man in the crowd stepped forward briskly and picked out a card. The con man placed the bit of cardboard on a table so that only one side showed. It was white.

"Well you've obviously not picked the red-red card," the operator said. "That means there's an even chance the other side is red or white. Tell you what I'll do. I'll bet you a dollar to six bits that the other side of the card is also white."

Seems generous, doesn't it? Slightly in the man's favor. Yet the con man is bound to win in the long run. Why? What are the real odds?

I'VE tried this one on friends. Normally I avoid such tactics since it invites retaliation, but I was curious to see how often it stumped them.

A man walked into a clothing store and paid for a three-dollar pair of gloves with a ten-dollar bill. The owner didn't have change for the ten, so he went next door to the drug store and changed it there. Then he came back and gave the

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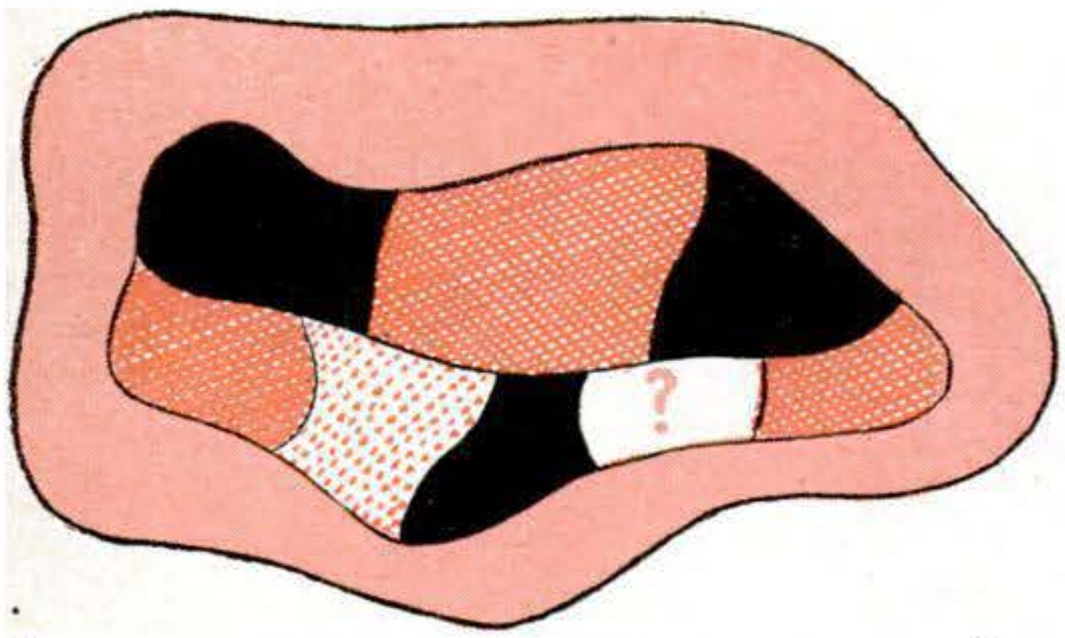
customer his seven dollars in change.

After the customer had gone the druggist came rushing in. "Say, that ten-dollar bill you gave me is a phony. Give me my money back!" And of course the clothing-store owner had to make good the amount.

The question: How much did he lose?



HERE'S a puzzle that nobody has solved yet. It's the Four-Color Problem. What is the least number of colors needed to shade any map and still keep neighboring regions distinct? A look at the example suggests that it would take five. But it can be done with four. Do you see how?

Experience points to four as the general answer to the map-coloring question. But experience isn't enough for mathematicians. They want a general proof that four colors will always work for any map any time. If someone drew a map that showed five regions, each of which shared a border with all four others, the four-color theory would be shot. Because nobody's done it yet, doesn't mean it can't be done. Care to try? (Regions must border along a side, not just at a single point.)

Puzzle of the month

LEWIS CARROLL designed a very odd garden in a chapter of *A Tangled Tale*. It's flowerless because there are no plant beds. "It is oblong in shape—just a half a yard longer than its width—and a gravel walk, one yard wide, begins at one corner and runs all around it."

"Joining into itself?" asks a boy.

"Not joining into itself, young man. Just before doing that, it turns a corner and runs 'round the garden again, alongside the first portion, and then inside that again, winding in and in, and each lap touching the last one, till it has used up the whole of the area."

"Like a serpent with corners?"

"Exactly so. And if you walk the whole length of it to the last inch, keeping in the center of the path, it's exactly two miles and half a furlong."

A furlong is $\frac{1}{8}$ mile. How big is the garden? (Answer next month.)

Answer to last month's P-O-T-M: How many transfers are needed to remove 64 disks of graduated size from one needle to either of two others, if you require that only one disk at a time can be moved and no larger disk can ever rest on a smaller one?

This is a neat case of induction: reasoning from the one to the many. Start with two disks, in order of size, 1 and 2. Let the needles be a, b, and c. Then if the disks are on a, three moves: 1b, 2c, 1c, are required to transfer them.

Now try three disks. The first three moves are the same. Then you continue with 3b, 1a, 2b, and 1b, adding four more moves for a total of seven. For four disks you repeat these seven moves and add eight more: 4c, 1c, 2a, 1a, 3c, 1b, 2c, 1c, for a total of 15. Now the rule suggests itself. If n is the number of disks, the number of transfers is $\underbrace{2x2x2x\ldots2}_{n \text{ times}}-1$ (or 2^n-1).

So it'll take $2^{64}-1$ or 18,446,744,073,709,551,615 moves to transfer the disks. At a rate of one transfer per second the job will take about 58 billion centuries!

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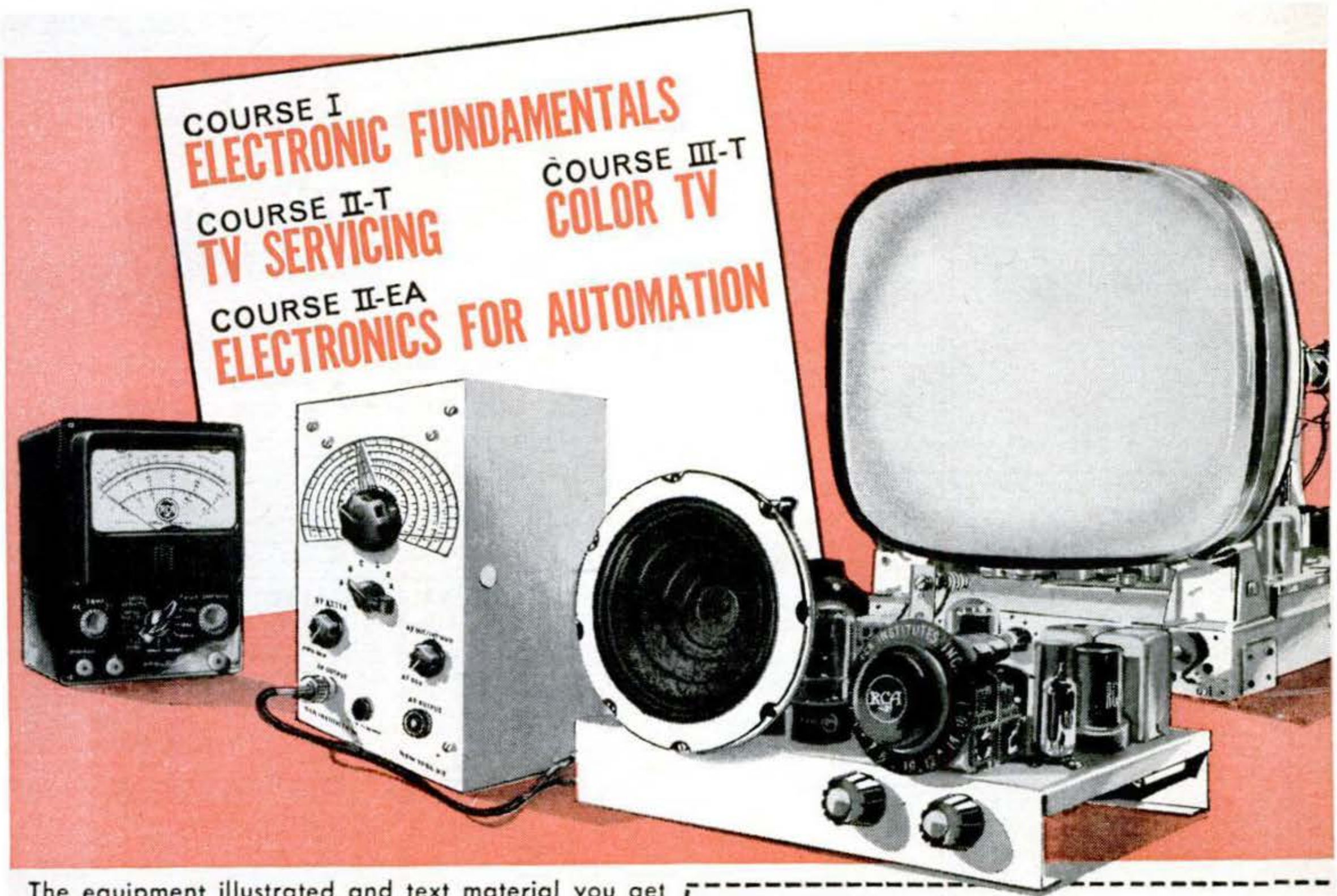

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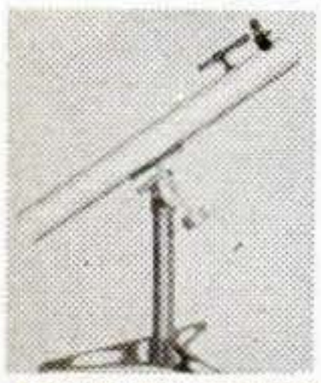

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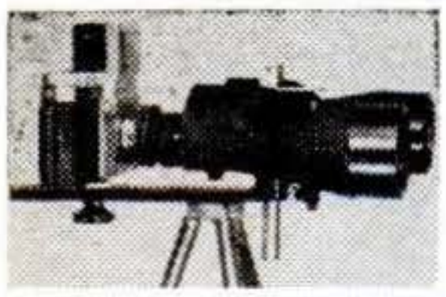

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By Martin Mann

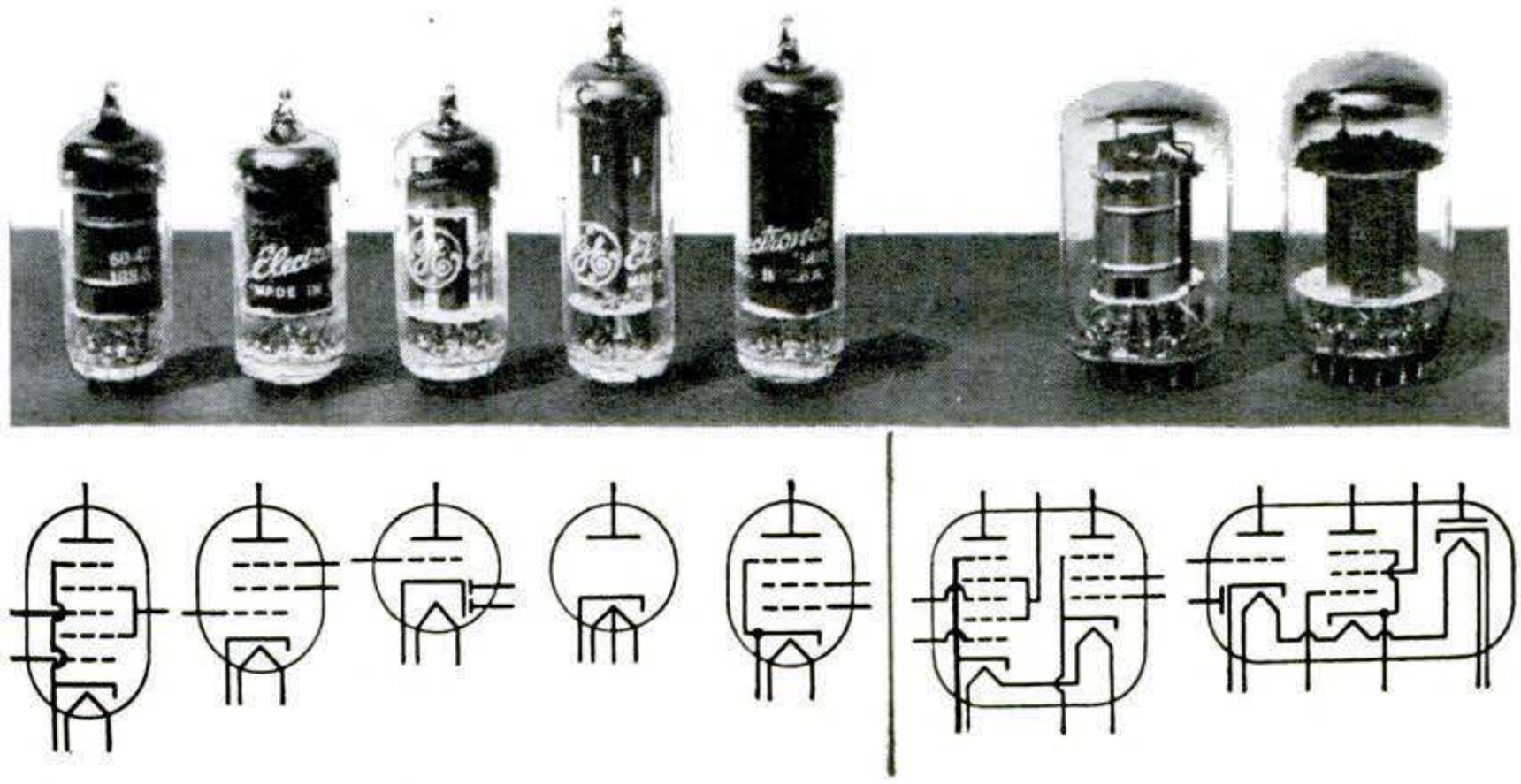
The month in science

Cheaper TVs coming? A new breed of vacuum tubes promises to cut the cost of television, radio, and hi-fi—but not necessarily for you.

General Electric has developed a whole set of multiple-function tubes, each containing the works of several ordinary vacuum tubes packed inside one small glass bulb. The idea is not new, but no one has applied it so intensively before. One of GE's "compactrons" (for a radio) combines a detector diode, triode amplifier, pentode beam-power amplifier, and half-wave rectifier diode all in a single envelope.

This businessman's blueplate is cheaper (by 20 percent) than the same things ordered à la carte. And there are also important incidental savings in the use of compactrons: Fewer sockets and other parts are needed, assembly time and labor are reduced, the finished product is smaller. GE proudly claims: Compactrons are smaller than vacuum tubes, better than transistors, and less expensive than either.

The first sets using compactrons should be on sale next year: a table radio containing two compactrons (replacing the normal five tubes) and a TV containing 10 compactrons (replacing 15 tubes).



The five tubes at left above merge into just two short, fat "compactrons."

Will they sell for less than present sets? GE refuses to commit itself, but the implication is no, not right away. Tubes and sockets account for only a small part of the cost of a TV or radio set, anyhow.

That's not all. A swing to multipurpose tubes on such a grand scale is almost sure to stick you with higher repair charges. When one section of a three- or four-function tube burns out, you have to replace the whole thing—at three or four times the cost of the single-purpose tube (less that 20 percent). Tube burnouts are the most common cause of trouble in TV sets, but are rarer in radios. Compactrons are said to be less likely to burn out than ordinary tubes. The factory guarantee, however, is no different.

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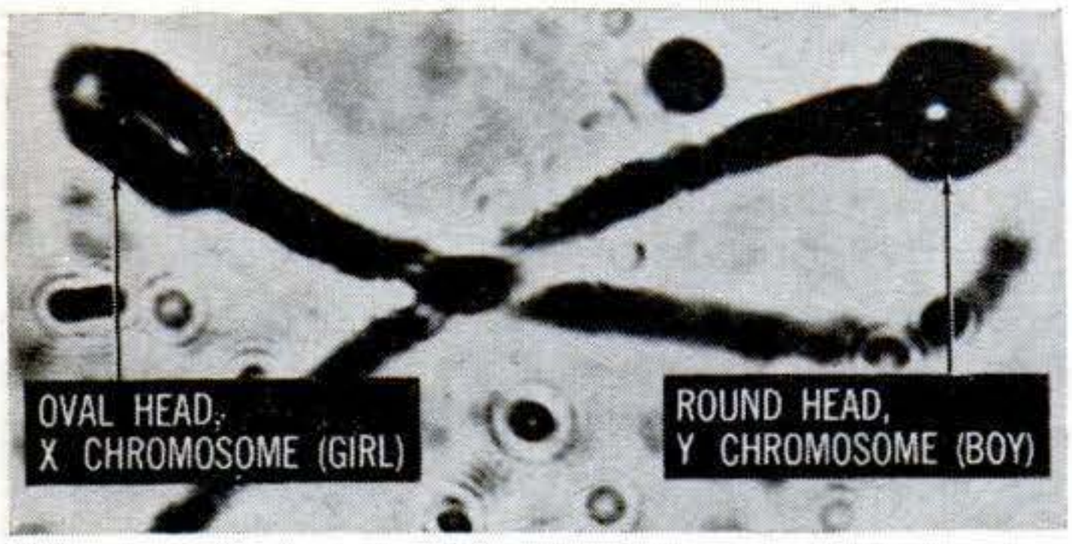
It looks like a repeat of the history of printed circuits: an important manufacturing economy that failed to reduce retail prices appreciably, and did skyrocket repair costs, at least during the first few years.

How to tell the boys from the girls. Scientists have known for a long time that father deserves the credit (or blame) for the sex of his children (the Shah of Iran is apparently unconvinced). But in all the years that they have peered through microscopes at human sperm, they could never see any great difference in its appearance. Boy-making sperm and girl-making sperm looked pretty much alike.



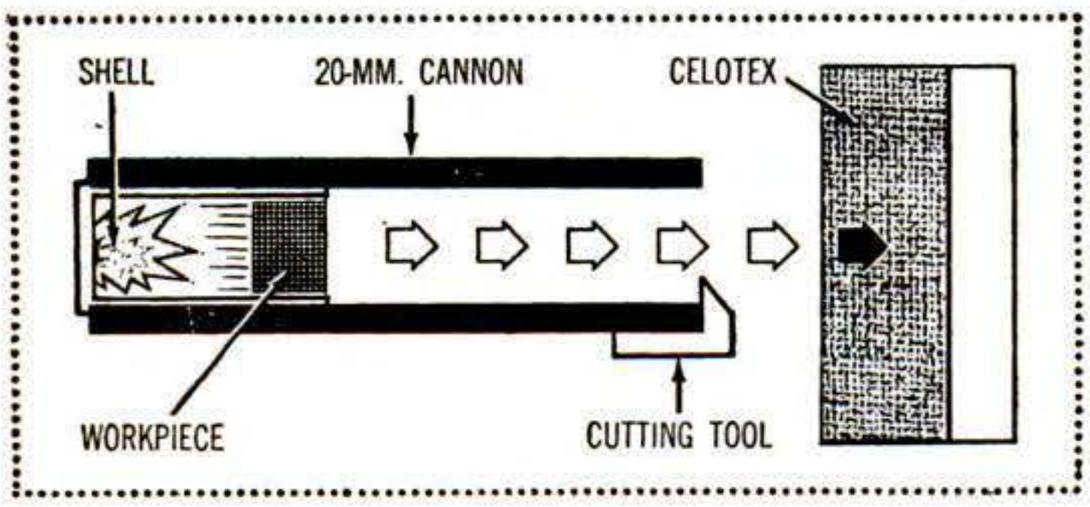
HUMAN SPERM of two types are revealed by microscope. Sex of baby is set by combination of father's and mother's chromosomes. Mother's egg always contributes X type. X-X combination leads to girl, X-Y combination to boy.

Last summer Columbia gynecologist Dr. Landrum B. Shettles took another look. He tried a phase-contrast microscope, invented in the Thirties and only recently come into general use. It reveals details in biological samples without requiring chemical stains, which sometimes distort the samples. And he saw a difference. Slightly more than half the sperm had small, round heads. The rest had large, football-shaped heads. There were no in-between shapes.

Dr. Shettles' conclusion: The small heads contain Y chromosomes, the hereditary patterns that lead to boys. The large heads contain X chromosomes, which lead to girls. This checks with what is already known about the size and shape of chromosomes. The extra number of small-headed, Y-chromosome sperm also checks: On the average, more boys are born than girls.

If this discovery proves out, it may fulfill an ancient dream of men, from Shahs to peasants. The smaller, boy-type sperm ought to move faster than the girl-type. The difference in speed of travel might be exploited to control the sex of babies—give parents boys or girls, on order.

Machinework shot out of a cannon. Lockheed engineers have been testing a weird idea: using a 20-mm. cannon for a milling machine. They load the workpiece into a cartridge and fire it from the gun past a cutting tool (held on an arm fixed to the barrel) and into a box filled with Celotex. Works fine. On tough steel and titanium alloys machining speeds run to 250,000 surface feet per minute. This is 6,000 times faster than such metals can now be cut. The high speed pays off with smoother surfaces and less wear on the tool.



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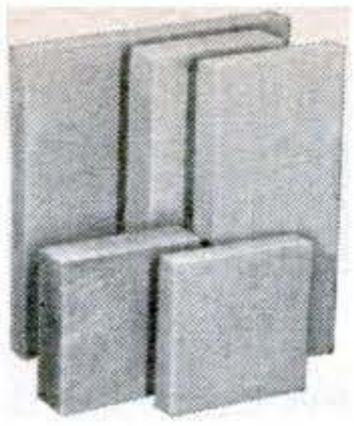

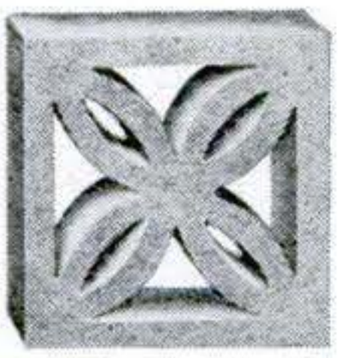

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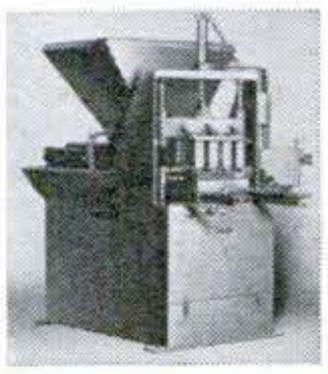

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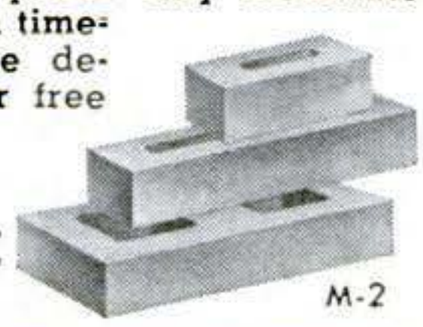

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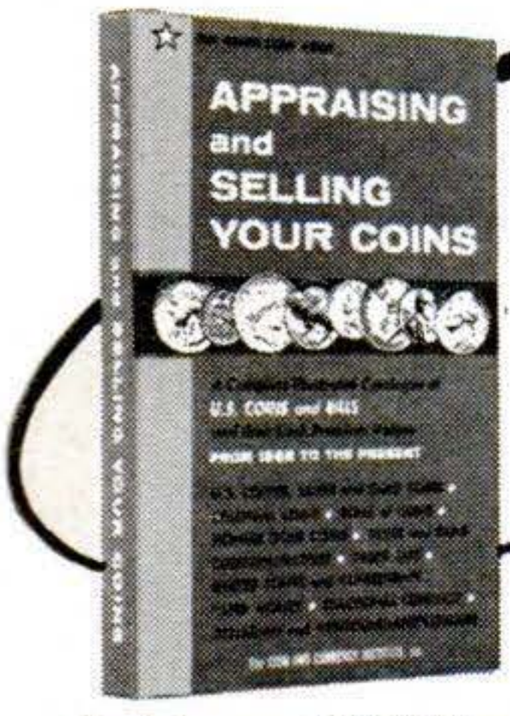

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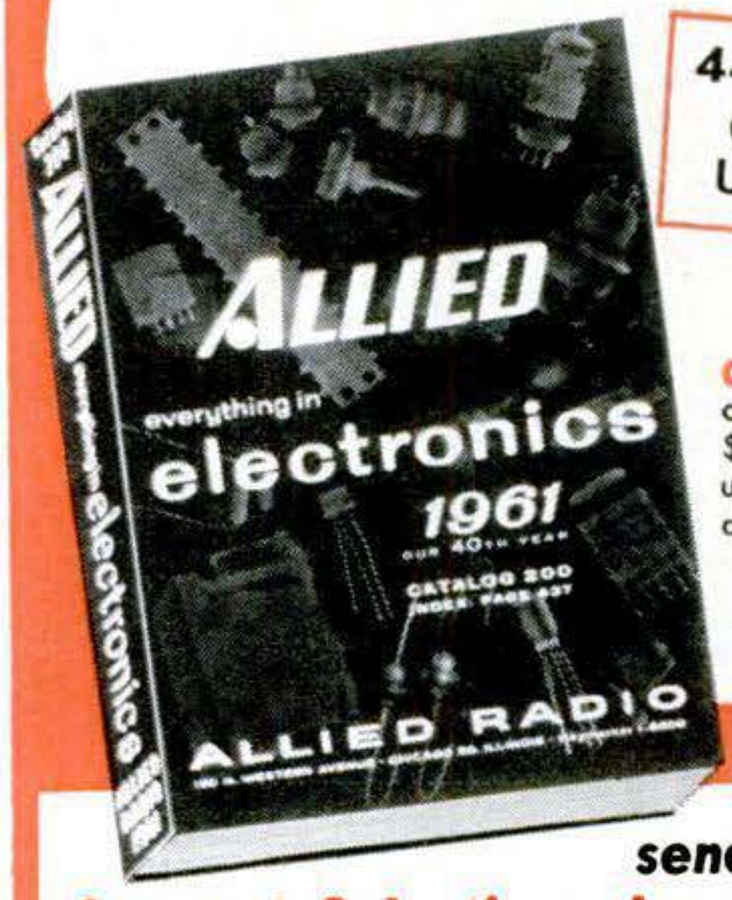

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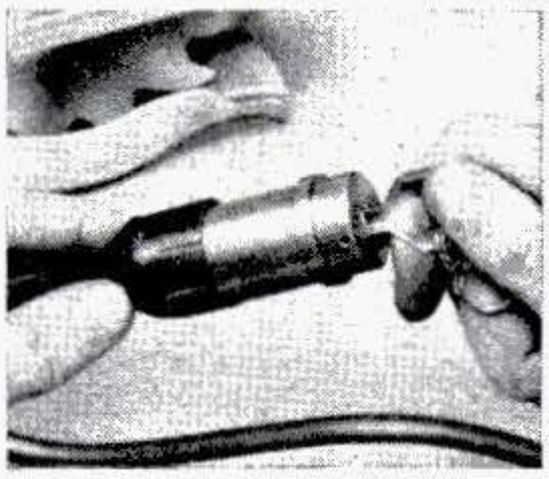

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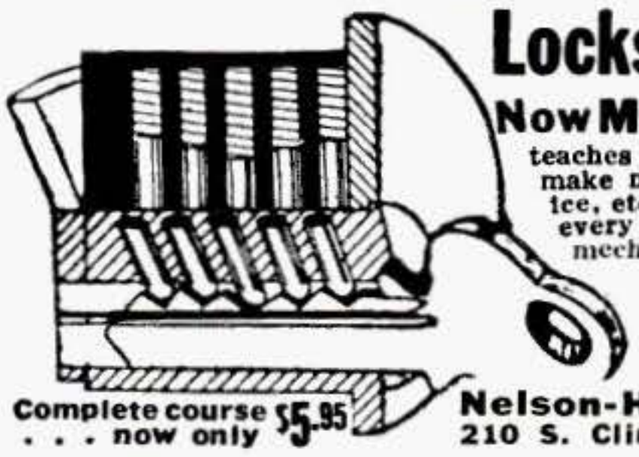

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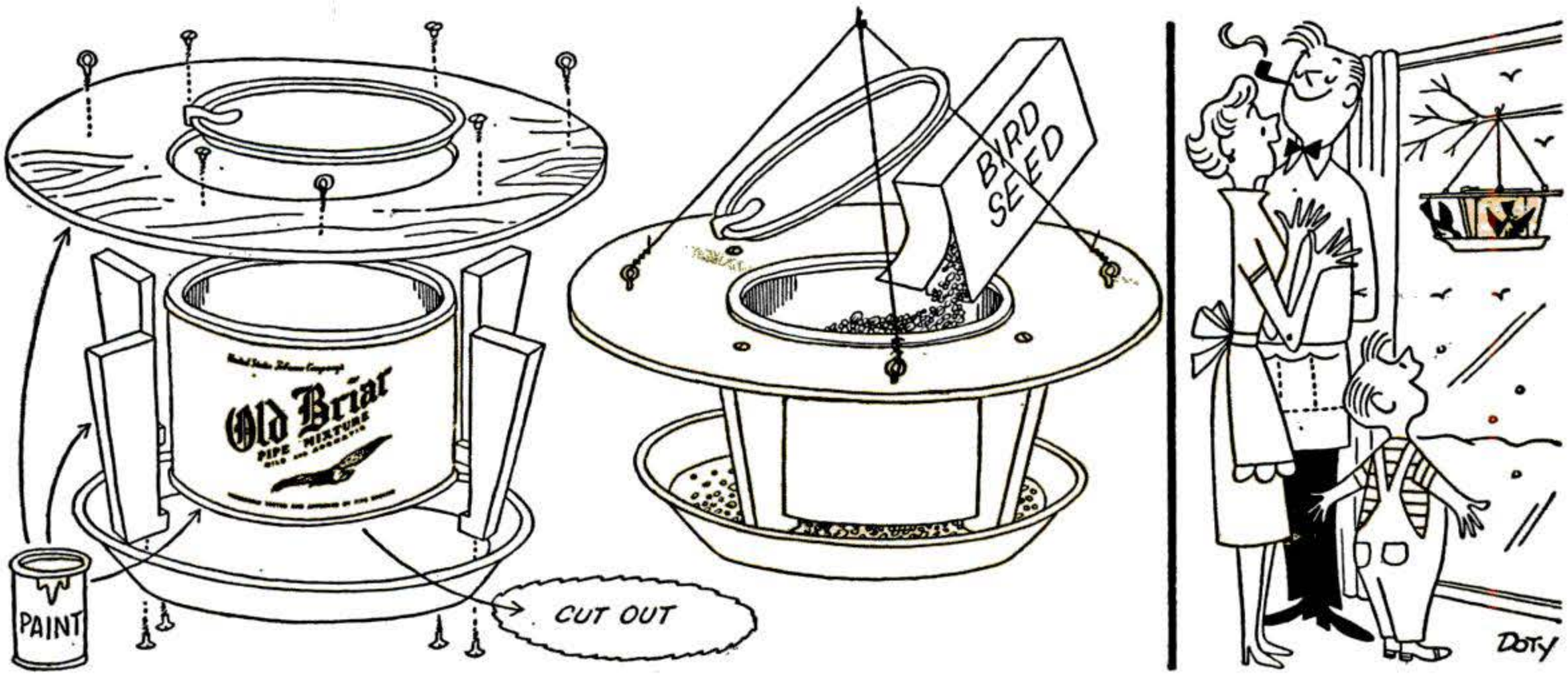

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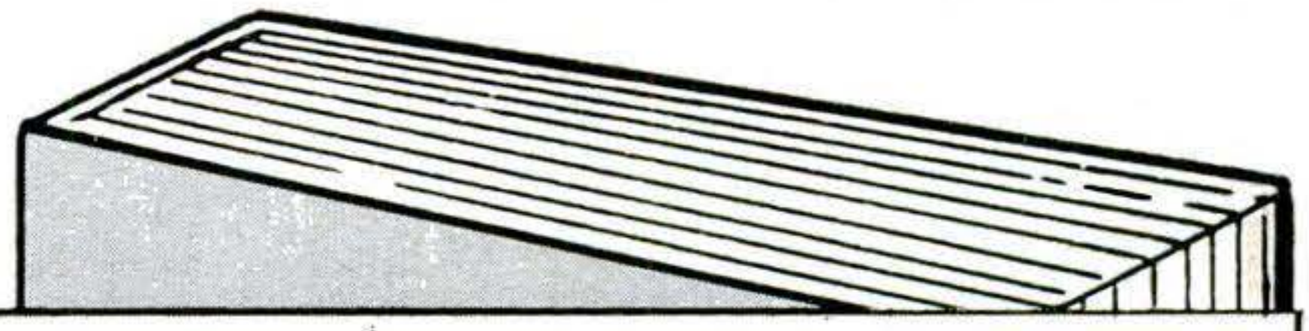

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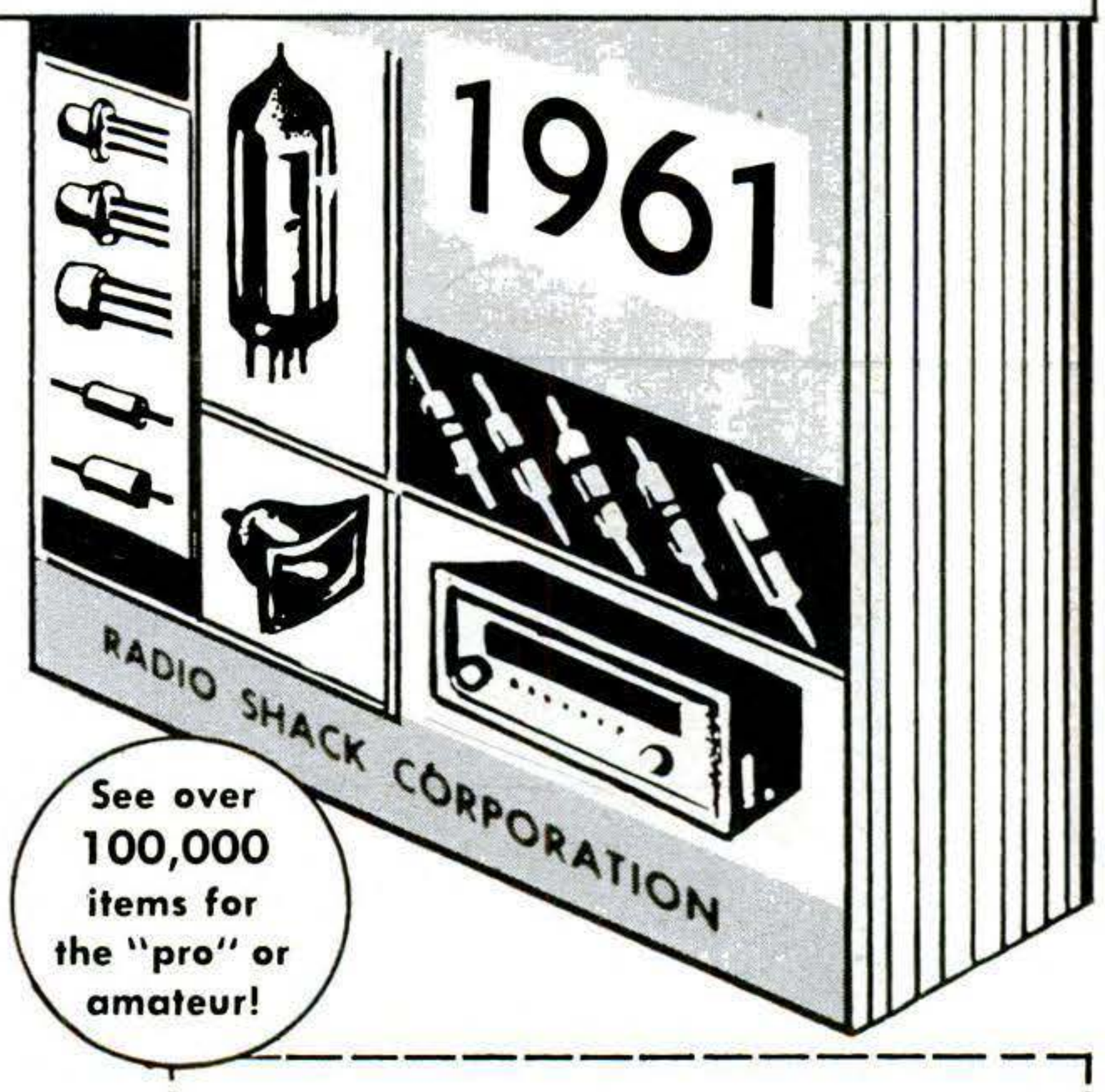

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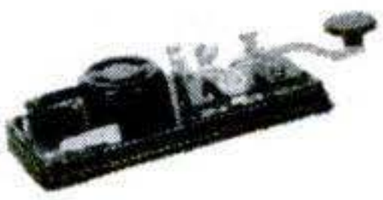

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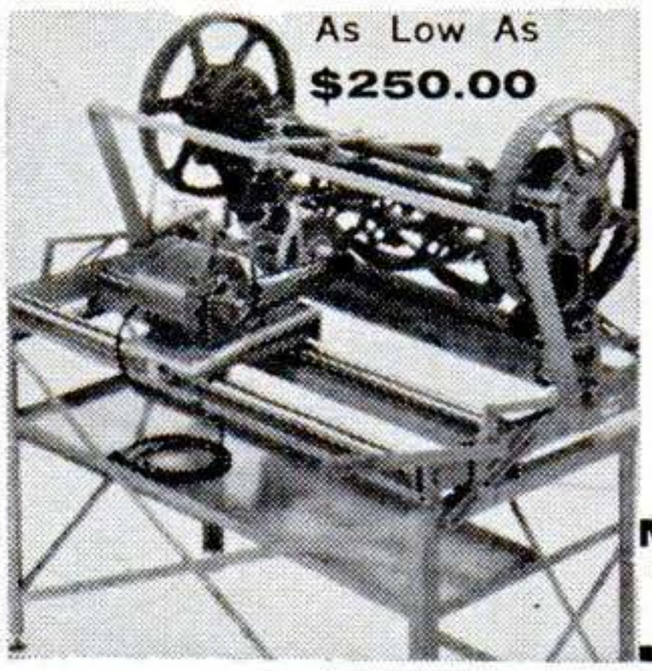

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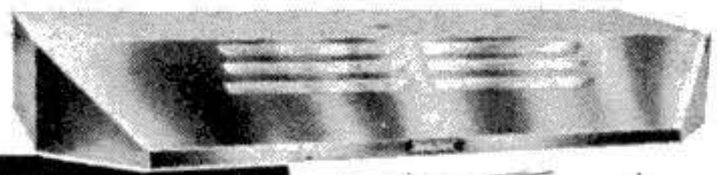

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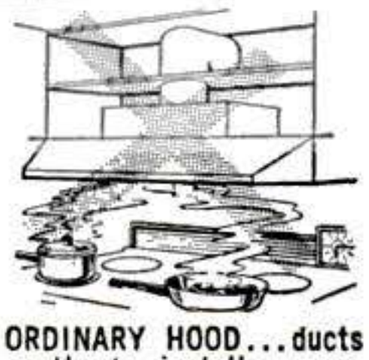

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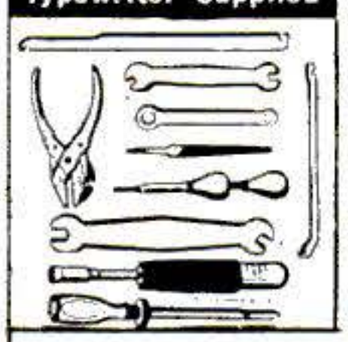

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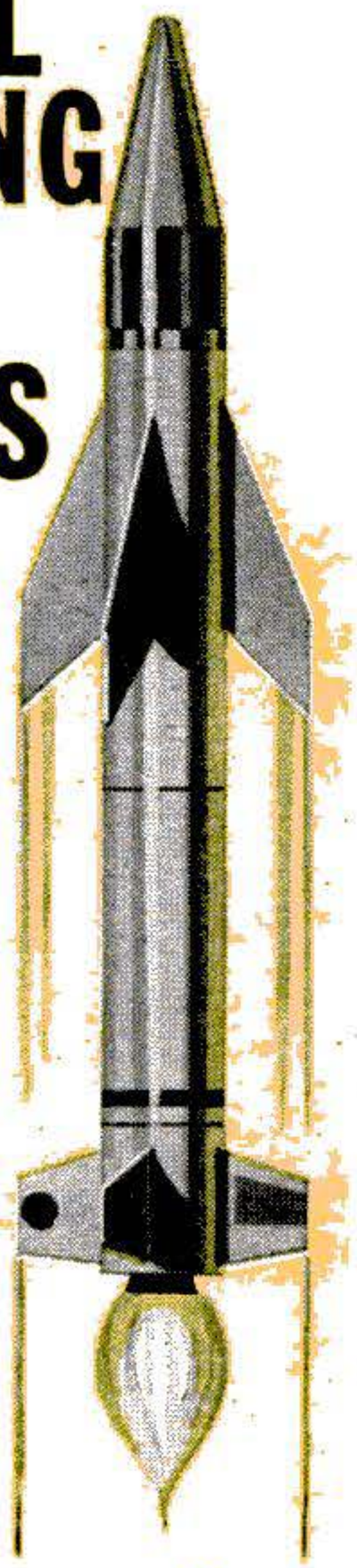

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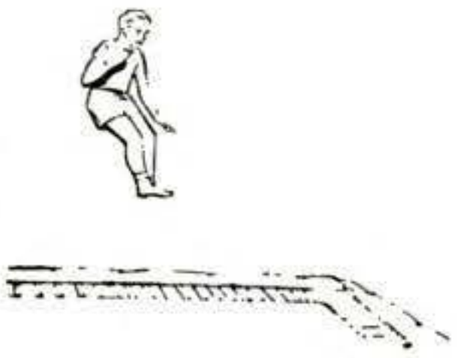

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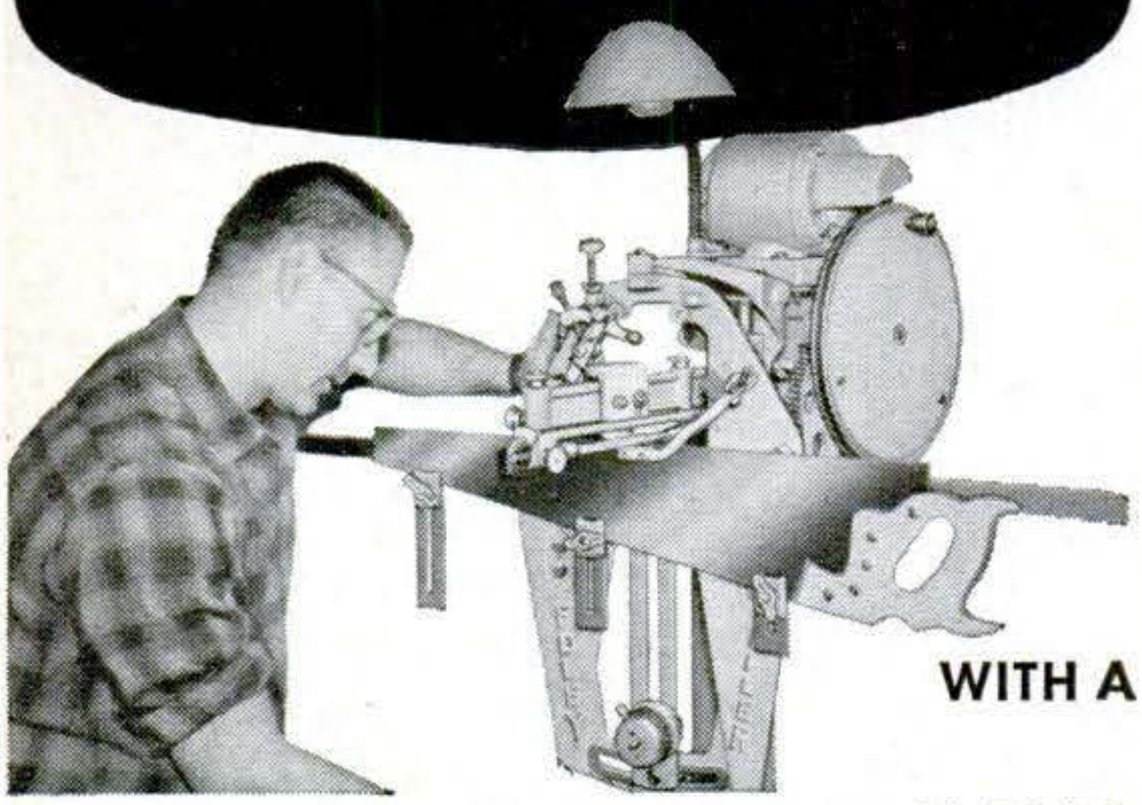

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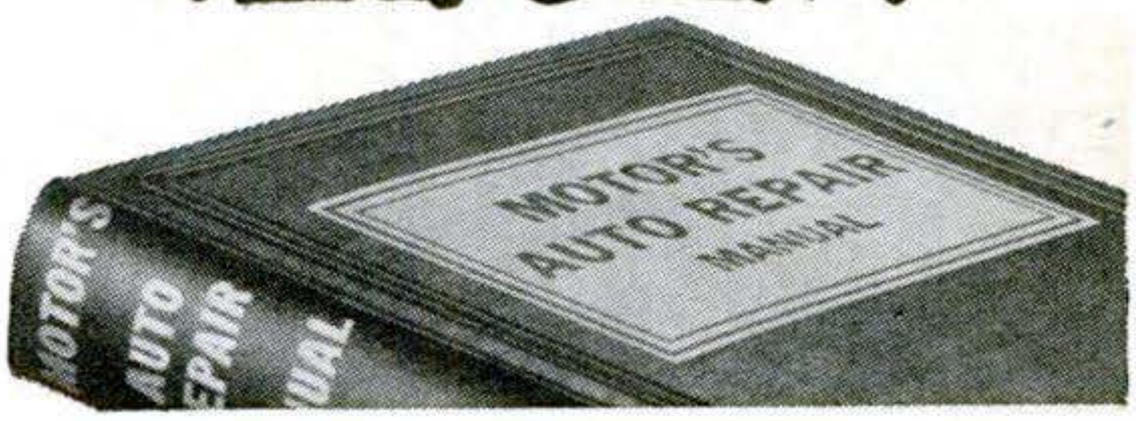

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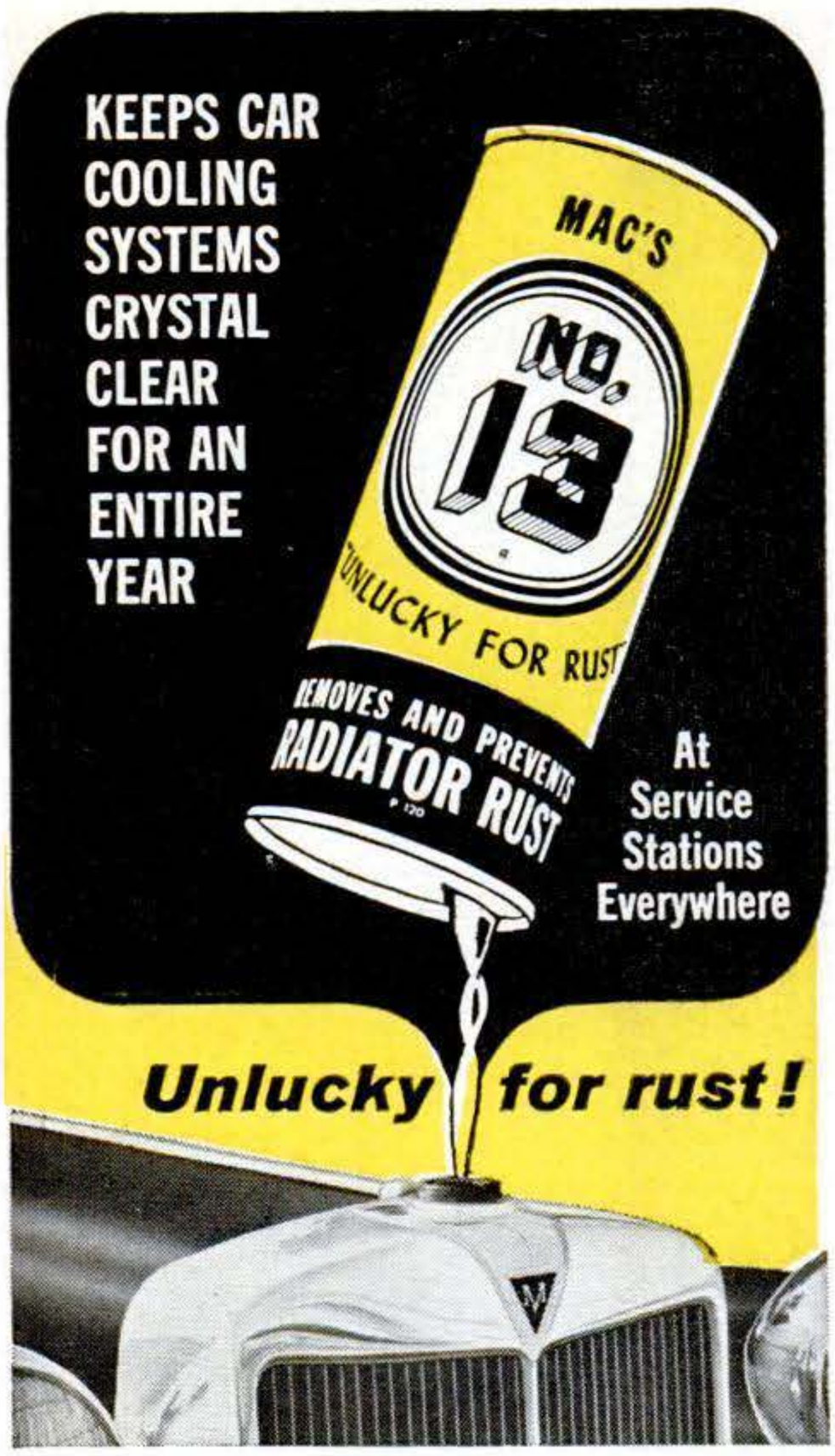

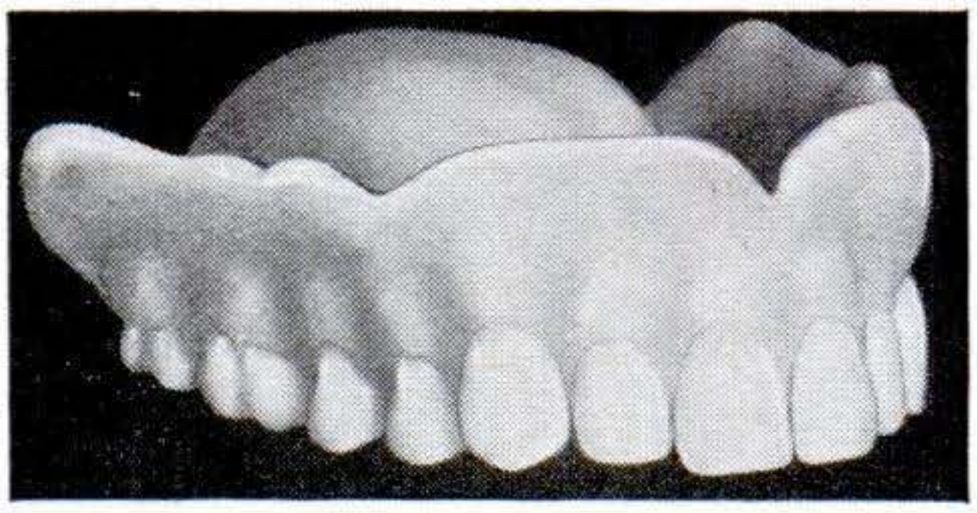

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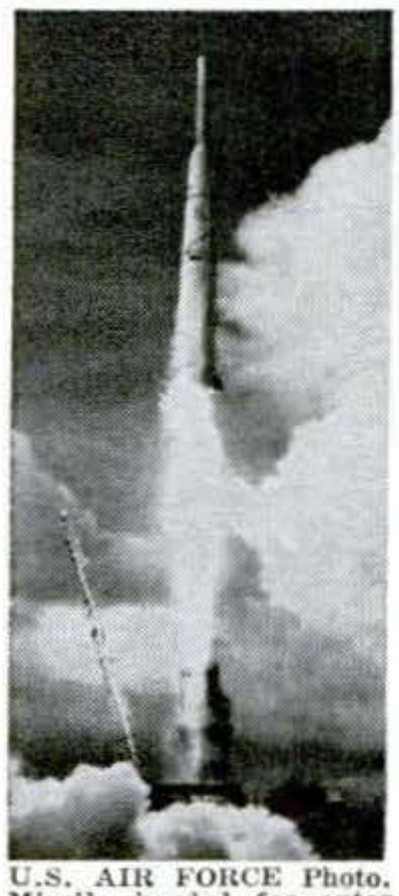

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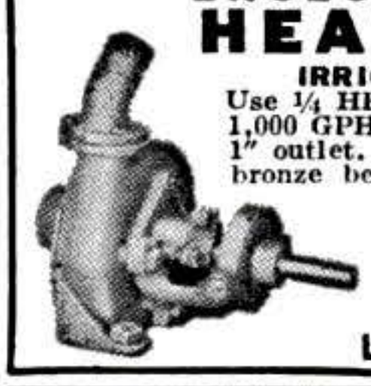

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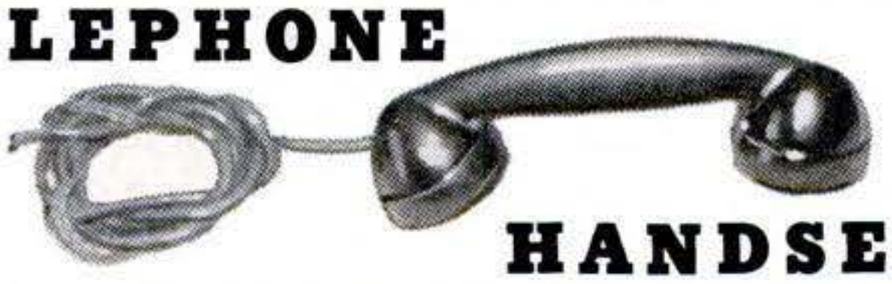

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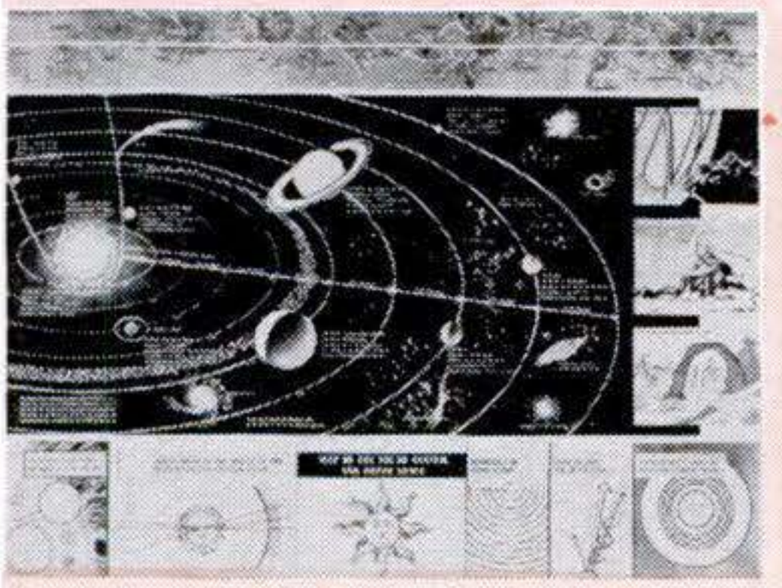

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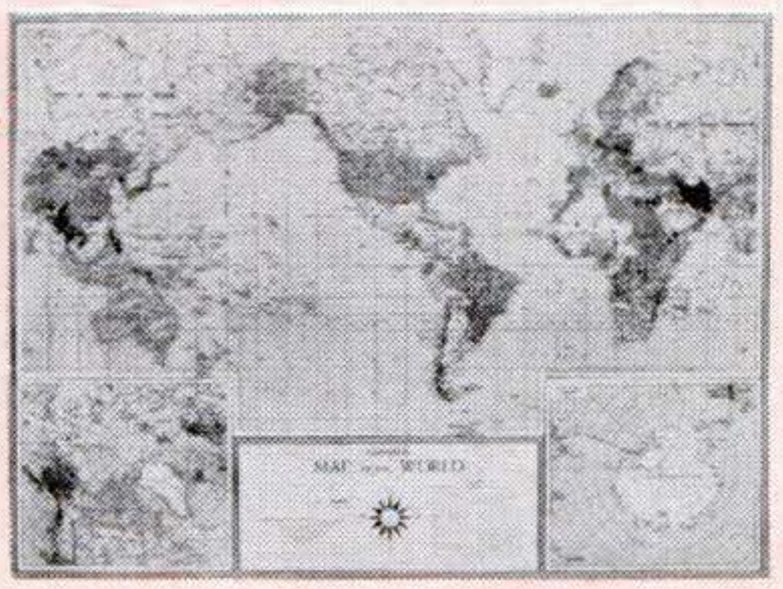

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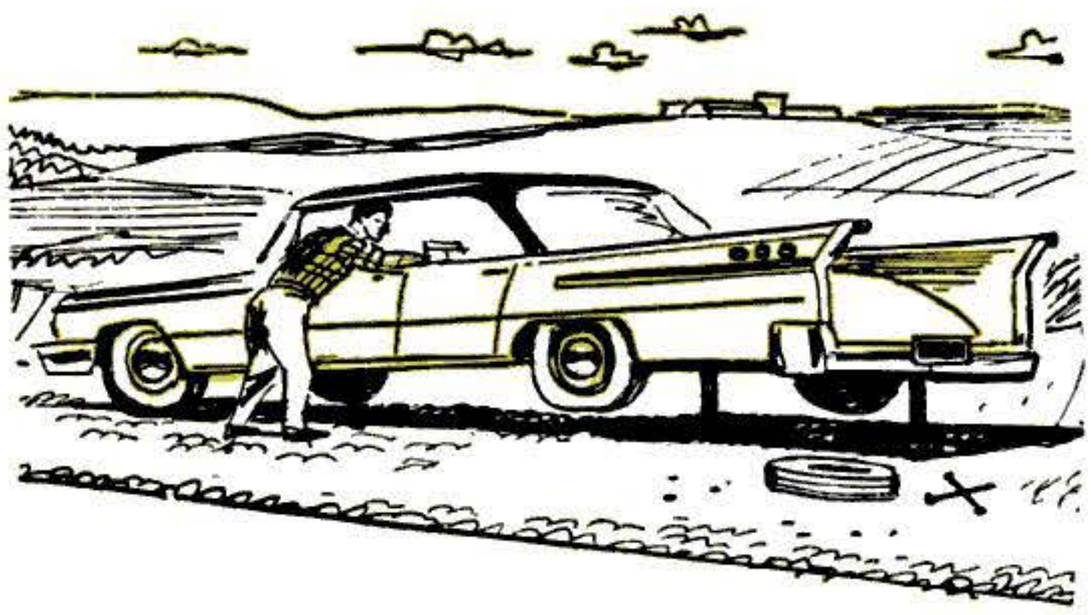
DETROIT REPORT

By Ken Fermoyle *PS Detroit Editor*

Compacts Vs. Used Cars

IF YOU'RE in the market for a good late-model used car, you've never had it so good, surveys show. If you have a one-, two-, or three-year old car you plan to trade in for a new one, you may be disappointed at the allowance a dealer will give you.

It's the fault of the compacts. Many dealers report that customers who normally buy a clean used car of recent vintage—at, say, $2,000—have discovered they can buy a new compact for about the same money. Result: Prices generally are down on the newer used cars. Models in the $1,000 to $1,200 bracket still sell briskly.



Power jacks for luxury cars? Jacks that hoist a car at the press of a button may soon be an accessory on at least one top-priced, domestic luxury car. (Power jacks have long been used on expensive foreign models and were virtually standard equipment for Indianapolis race cars in this year's 500.) One Detroit auto company is considering them for 1961; several other makers are including them in later plans. Reason? Aside from their sales-boosting novelty, power jacks would solve the increasingly difficult problem of raising a car for tire changes with a manual jack. Bumper shapes are so complex it's often hard to attach a jack, and big luxury cars are so heavy that the jacks often slip when you do get them in place.

Rubber companies happy. The trend to cars with integral bodies has boomed the sale of rubber insulators in Detroit. Unit-bodied cars transmit noise throughout the automobile more readily than cars built with separate frames—so noise suppression is critical. Engineers use liberal quantities of rubber at points

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Look for more use of a special butyl-rubber compound in these insulators. Pioneered several years ago by Mercury in its spring rebound bumpers, the stuff seems to defy the laws of physics. It does not give equal reaction for every action; it absorbs energy. Drop a butyl ball and it plops to the floor with scarcely a bounce. Thus it can not only suppress noise but also soak up road shock. It's expensive, but engineers feel its benefits outweigh cost, and plan to use more of it in future cars.

Converting a Corvair. You can't buy convertible Corvairs from the factory, but a Michigan Chevy dealer now makes a kit that turns standard coupes into soft-tops. You get underbody support braces, a manually operated canvas top, windshield-header locks, and padded pillar replacements that fit into the glass channels. (You have to whack off the old steel top, of course.) Ray MacGillivray, Vassar, Mich., dealer, makes the conversion kit for sale to other dealers. It brings the price of a Corvair to about $150 above that of a standard coupe.

South American hybrid. Argentina's first locally conceived, designed, and engineered car, the Bergantin, recently joined the growing family of vehicles Kaiser builds in South America. It is made by *Industrias Kaiser Argentina,* an affiliate of Willys Motors.

The 2,800-lb. compact car uses a 76-hp., four-cylinder engine and a Willys-type chassis. The body resembles an Italian Alfa Romeo. It is 173 inches long and has a 103.3-inch wheelbase. Kaiser Argentina also builds Jeeps and Kaiser Carabelas (made from tooling used for the last series of domestic Kaisers), plus Renault Dauphines.

New engines due. "A new series of engines is coming, probably in the mid-1960's," according to Victor G. Raviolo, executive director of Ford's engineering staff. Current engines, designed in the postwar period, have been "developed and refined and exploited to something near the limits of their potential," he recently told a group of British engineers.

Raviolo expects the new engines to be lighter, but they won't necessarily have aluminum blocks. Improved casting techniques, he says, will make lightweight iron blocks possible and, "with the judicious use of aluminum for covers and manifolds, will result in total engine weight very near that of an all-aluminum engine, at substantially lower cost."

Gas-turbine engines? Not for cars. "There is little promise that costs equal to automobile gas-engine [piston] costs can be achieved," Raviolo feels.

Sixty seconds to stop. 400 m.p.h. to zero in 60 seconds is the task facing the disk brakes in Donald Campbell's Bluebird when the Englishman sets out after the world land-speed record this month. Hydraulic, flap-type air brakes will slow the car from a hoped-for 500 m.p.h. to a mere 400. The compressed-air-operated disk brakes must then pull the 8,000-lb. car to a halt in one minute—the severest brake test in automotive history.

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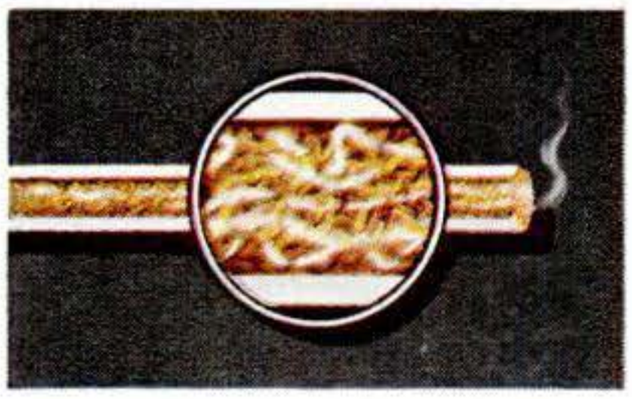

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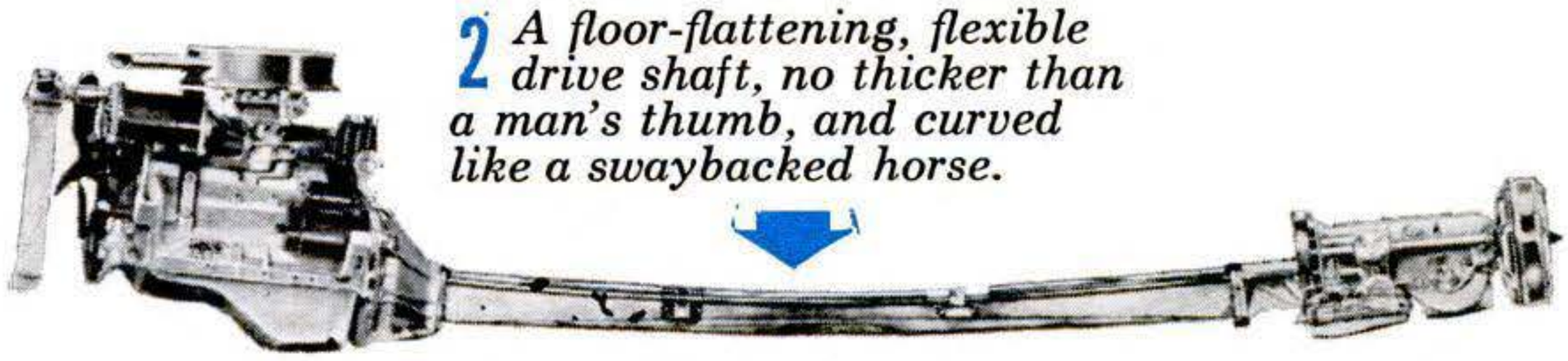
FIRST 1961 CAR

Pontiac Tempest: Radical New Compact

By Ken Fermoyle

WHEN the auto makers begin to unveil their 1961 models later this month, there will be three sparkling nuggets of mechanical news:



2 *A floor-flattening, flexible drive shaft, no thicker than a man's thumb, and curved like a swaybacked horse.*

1 *A four-cylinder engine—first for a big-volume U. S. car since the Ford Model A—which will be chopped from a standard V-8.*

3 *The first transaxle (a transmission built into the differential out in back) to be offered in a front-engined U. S. car.*

All three of these eye-poppers are packed into one car, Pontiac's compact new Tempest. (Add the Buick Special, Olds F-85, and Dodge Lancer—all due in the next five weeks—and there'll be a 1961 lineup of 10 U.S. compacts, almost half of all Detroit nameplates.)

Pontiac took *Popular Science* behind the brick walls of its Engineering Center last May—and we've been busting to tell what we saw ever since. The powers at Pontiac finally said okay. So now—on the next five pages—here's an advance look at some fresh engineering ideas for 1961.

CONTINUED

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1. The Four They Sliced from a V-8

DON'T expect to see something like a Model A engine when you raise a Tempest hood. In the Indianapolis Four, as Pontiac calls it, the cylinders lean a lazy 45 degrees to the right. Pushrods jiggle the overhead valves. Full pressure lubrication, hydraulic valve lifters, and all the other features of the latest V-8s are there. This is hardly strange, since the Tempest engine is actually the right-hand bank of the big Pontiac V-8, modified only slightly.

This means that it's far from a puny sewing-machine engine, like the fours in many imported cars. It displaces a healthy 194.5 cu. in. (bore, 4.06 in.; stroke, 3.75). With a single-barrel carburetor and 8.6:1 compression ratio, it pumps out 130 horses at 4,100 r.p.m. Mounting an optional four-barrel carburetor (unique for a four-cylinder engine) and pistons that hike the compression to 10.25:1 jacks the horsepower to 160 at 4,800 r.p.m. That's more than any U. S. six-cylinder engine offers—even though many have greater displacement.

Pontiac tests show 0-to-60 m.p.h. acceleration in about 12½ seconds with automatic transmission, even better with a stick-shift gearbox.

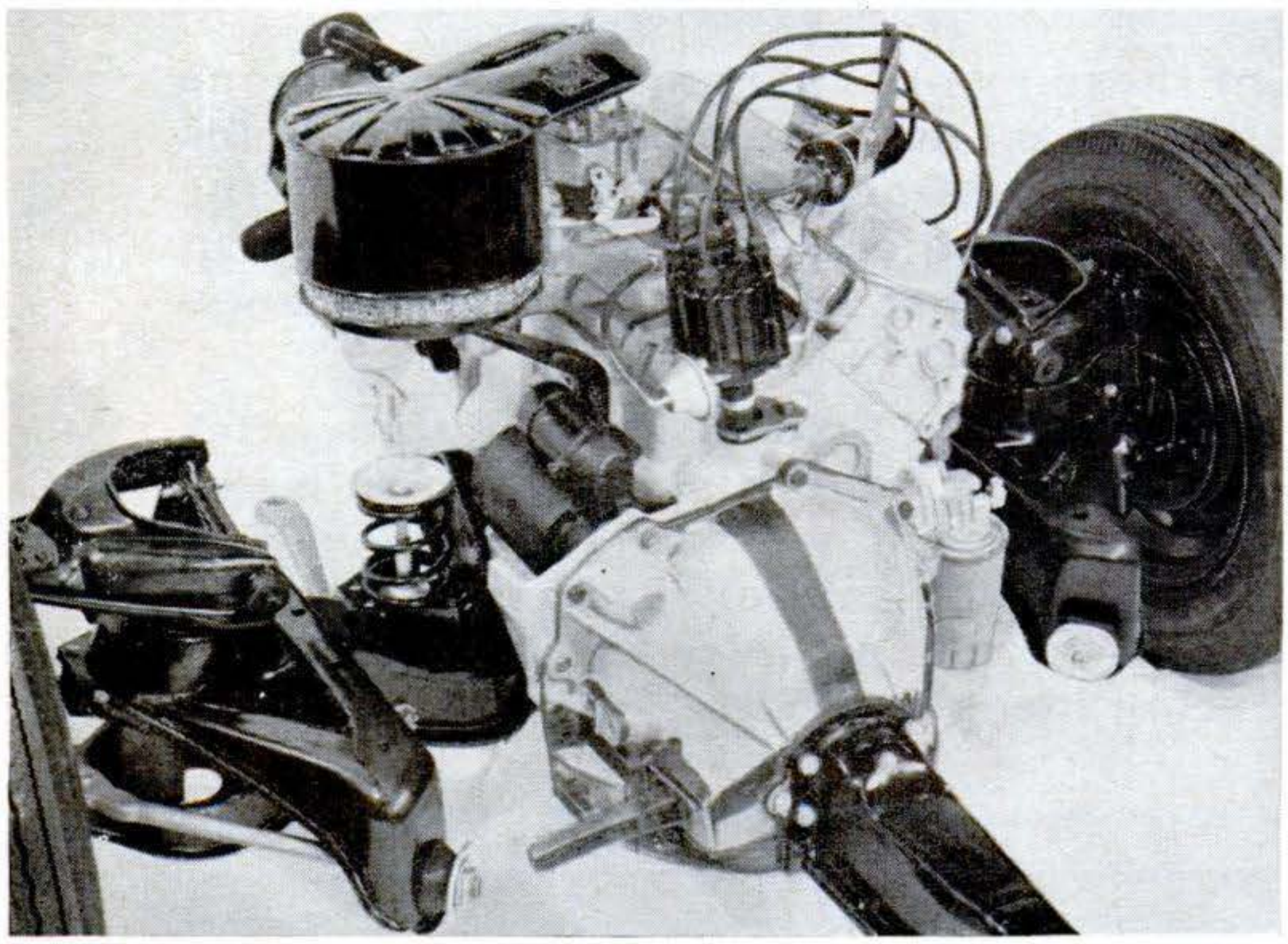
Does gas mileage double when you chop an engine in half? Not necessarily. Pontiac engineers expect 20 m.p.g. or so in normal, around-town driving and nearly 30 m.p.g. at steady, legal speeds on the highway. Enthusiastic floor-pedaling will cut those figures, of course.

The Indianapolis Four will run down the same assembly lines as the Pontiac V-8. This helps explain Pontiac's decision to go the four-cylinder route for the Tempest: It holds down costs.

Engineers admit they were skeptical when the four-cylinder program began. Later, they became converts. "The further we got into the job," one told me, "the more we realized that we had forgotten how many good things an in-line four offers." For instance:

- Manifolds, intake, and exhaust can be simple and straightforward. They're much less complicated than on V-8s or even in-line sixes. Cylinders aren't widely separated, so rich fuel mixtures aren't needed to make sure the most distant ones don't starve. This boosts m.p.g.
- Big cylinder bores, compared with sixes and V-8s of comparable displacement, accommodate bigger valves, which help the engine breathe deeply and perform well.
- The simplicity of a four means that there are fewer things to go wrong and fewer parts to replace when they do. Fours are easy to work on, too, so labor charges should generally be lower.

Aside from manufacturing economies, Pontiac engineers like the durability



TILTED ENGINE looks naked with just the bell housing, and no transmission attached. Leaning the four leaves lots of room for mechanics to work on carburetor, starter, generator, accessory pumps, and other often-serviced items grouped on the engine's left. The strut, lower left, running to the front-suspension lower control arm is threaded. Its length can be varied easily, permitting fast front-wheel caster adjustments to be made.

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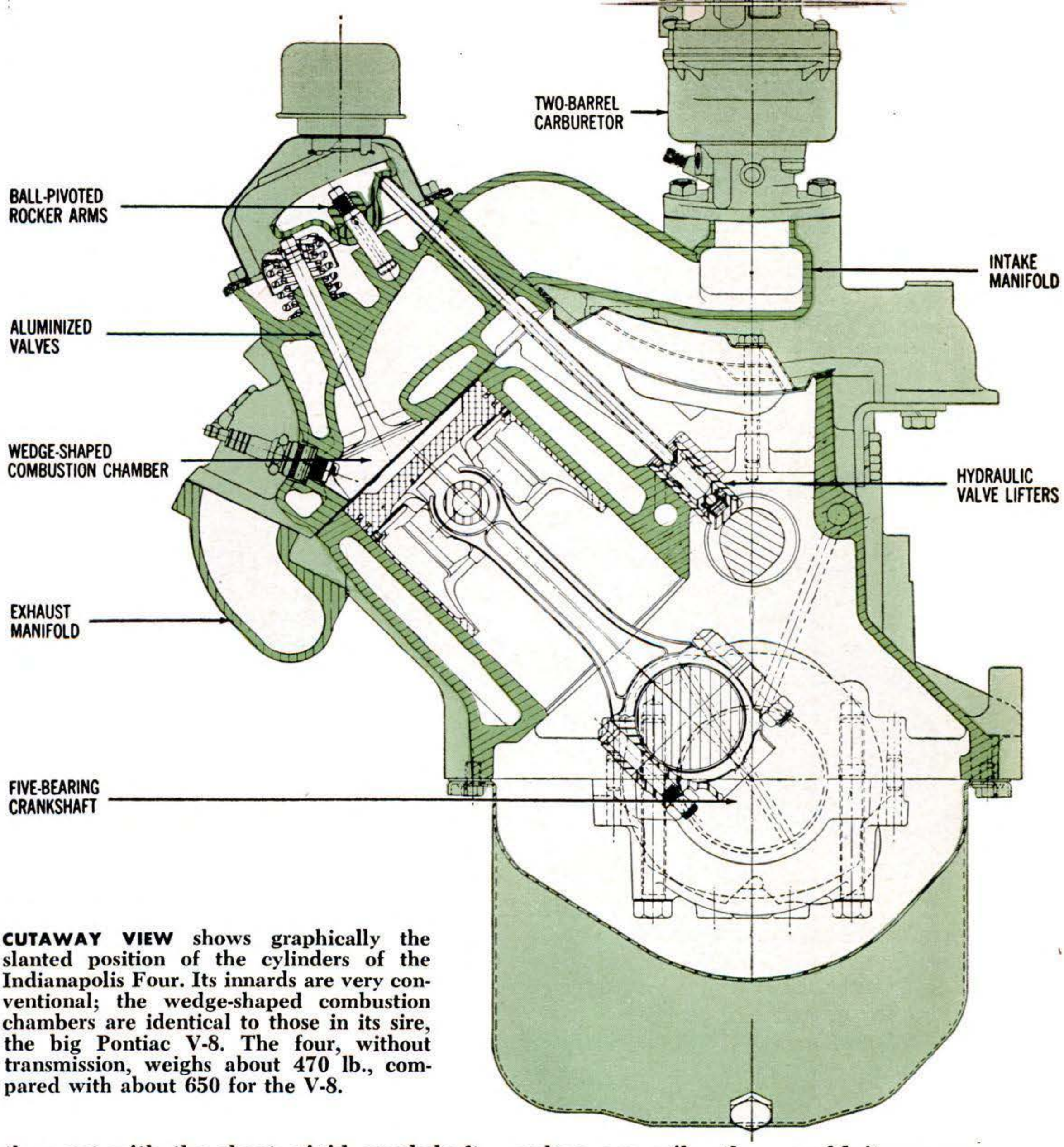

CUTAWAY VIEW shows graphically the slanted position of the cylinders of the Indianapolis Four. Its innards are very conventional; the wedge-shaped combustion chambers are identical to those in its sire, the big Pontiac V-8. The four, without transmission, weighs about 470 lb., compared with about 650 for the V-8.

they get with the short, rigid crankshaft in the Tempest engine. They also appreciate the wide-open spaces the tilted engine leaves in the engine compartment; they've got lots of room to hang on the starter, generator, power-steering pump, and other bits and pieces.

"Most of the problems that made the four go out of style have evaporated over the years because of new engineering developments, better production techniques, and improved materials," John DeLorean, Pontiac assistant chief engineer, told me.

Engine roughness was the biggest of those problems. Old-time fours rocked 'n' rolled on relatively primitive mounts. And because they delivered fewer, but proportionately more potent, power impulses per mile, they couldn't compare in smoothness with sixes or eights.

Pontiac planned a many-pronged attack on vibration. "You can almost say the whole car was designed around the mounting," DeLorean said.

The engine mounts are very soft. They let the engine wobble freely, but isolate the vibration from the body. The engine and unitized body-chassis are "tuned," so that their vibration frequencies tend to cancel each other.

Crankshaft imbalance isn't good in any engine, but it's critical in fours. Pontiac plans to precision-balance each shaft on an automatic machine, as it does for V-8s, to hold its dynamic balance within extremely close tolerances. Engineers de-

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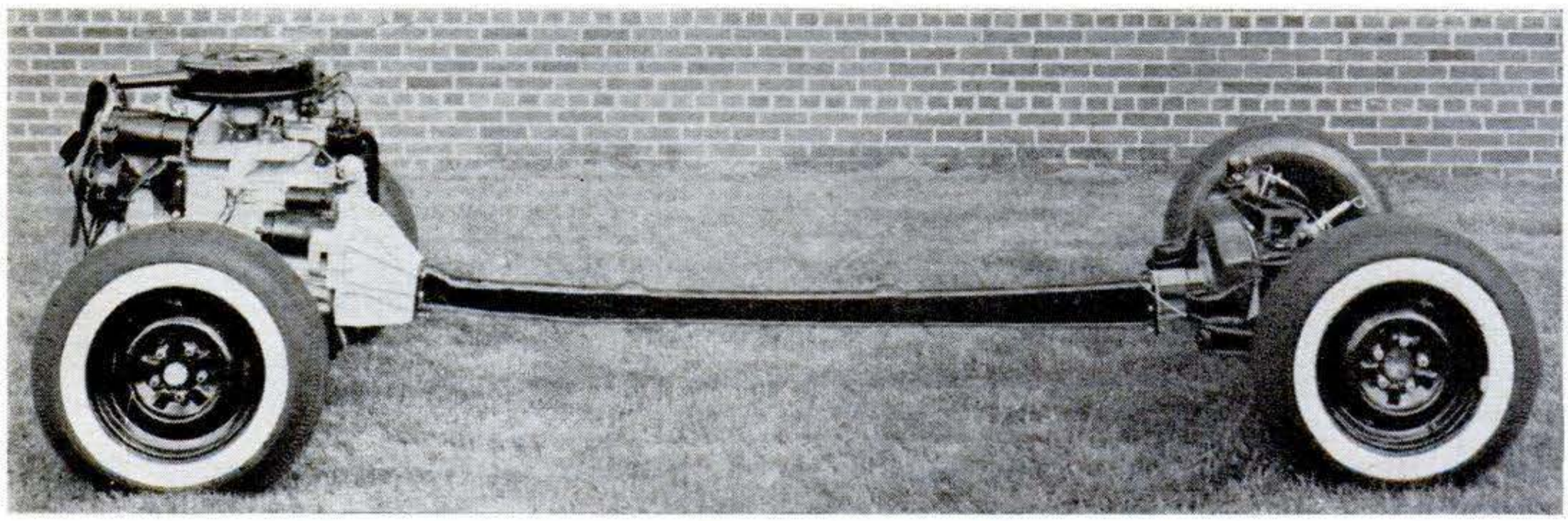
signed the crankshaft with four counterweights and added a harmonic balancer. They decreed that each engine's pistons must be balanced within $\frac{1}{16}$ ounce of each other. They took the whole lower end, five husky main bearings (many fours make do with three) and all, from the V-8 to insure a rigid foundation for the Indy Four. This adds up to what Pontiac feels will be one of the smoothest fours ever built.

How will it stack up against current sixes and V-8s? Very favorably, the company feels—but this is something that the public, not Pontiac, will decide.

Amputating the left bank of cylinders from the V-8 required surprisingly simple surgery. As one company man told me: "We just cut off the left bank and cast in a wall to cover the hole."

The camshaft has fewer lobes, but its position is unchanged. The generator

2. Drive Shaft Curves Like a Bow

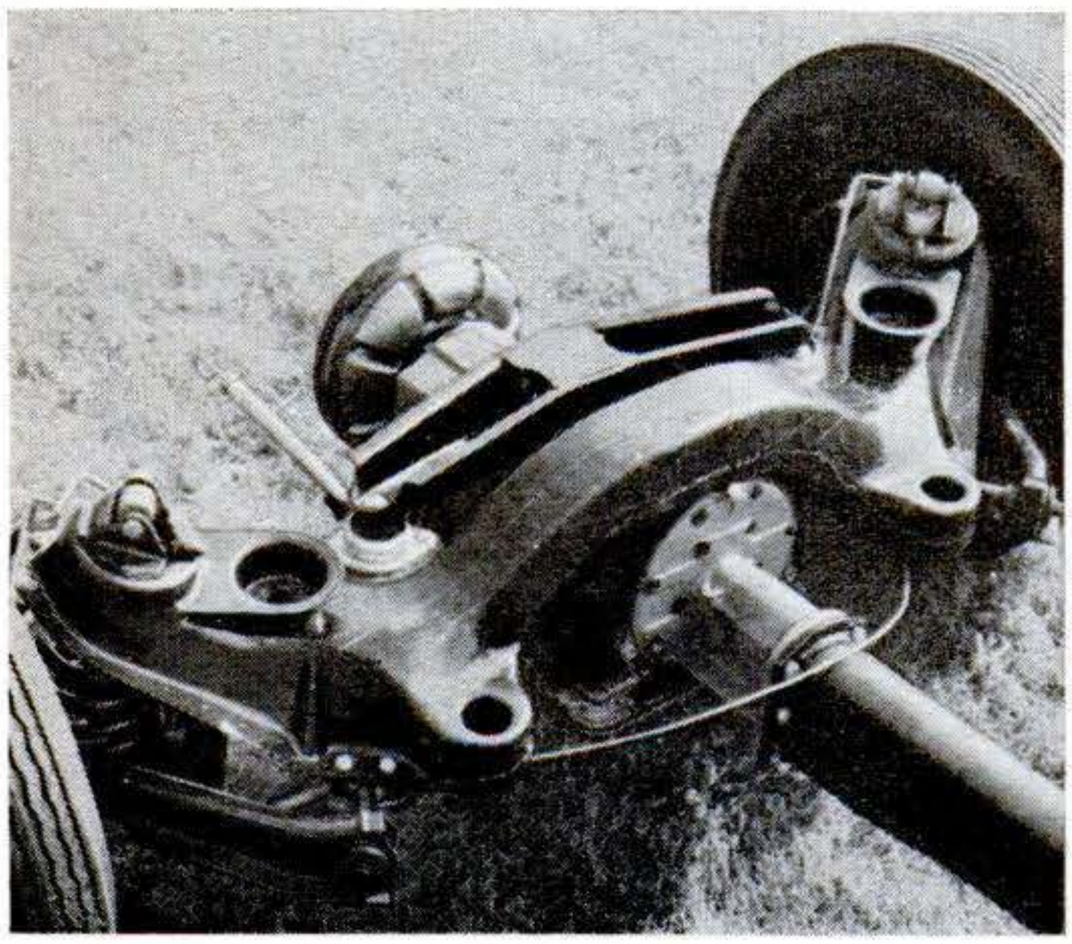


Curved drive shaft runs through the hollow member that joins front and rear running gear.

THE Indianapolis Four drives the Tempest's rear wheels through one of the strangest drive trains yet devised. Back of the engine is a flywheel, period. The transmission is in the rear, buttoned firmly to the differential.

A slender $\frac{5}{8}$-inch drive shaft—it looks like an elongated suspension torsion bar—links the engine and transaxle. It swoops rearward from the engine, curving somewhat like an archer's bow, through a hollow, boxlike torque tube that forms

3. Transaxle: Cogs in the Caboose



THE thumb-size drive shaft joins the transaxle just forward of the rear wheels.

In automatic-transmission Tempests, the shaft hooks into the transmission housing, which contains the two-speed planetary gearing. Back of this is the differential. Finally, hanging at the back, is the doughnut-shaped, three-element torque converter.

Pontiac calls the air-cooled automatic transmission (a much-modified Power-

TRAILING-ARM SUSPENSION is used at rear. Coil springs fit between pocket in "A" frame lower control arm and are recessed in cross member.

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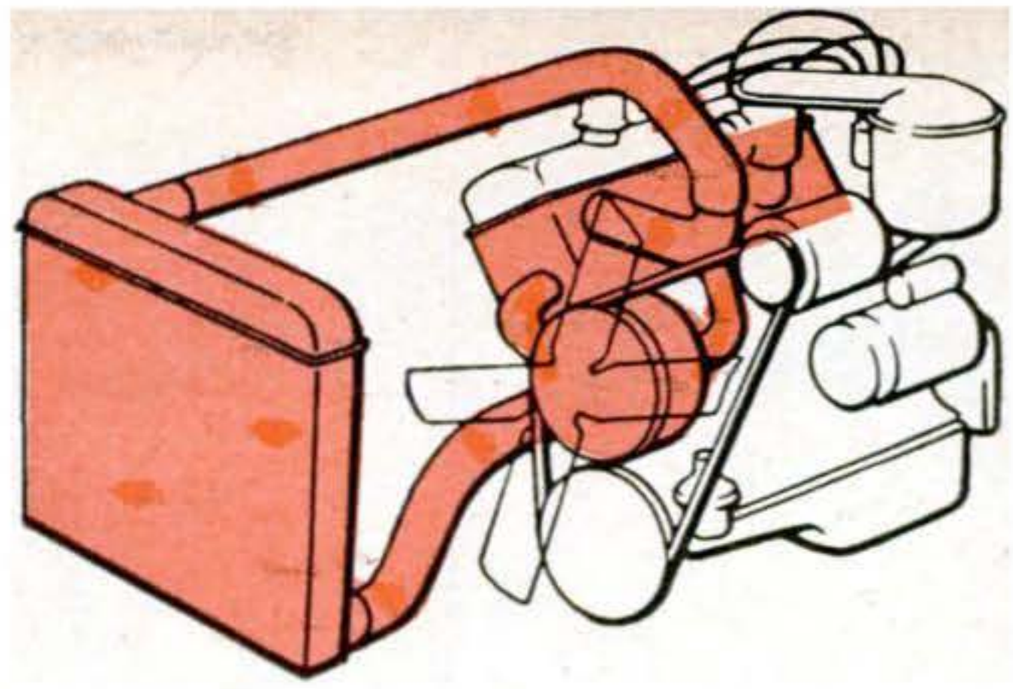
was dropped from the top right to the left side of the engine.

Since the oil pump is on the right side of the V-8, it did not have to be moved. The four's oil pan differs from the V-8's in shape and it holds one quart less oil. Internal lubrication—with oil under pressure going to crankshaft, connecting rod, and camshaft bearings, and to the valve train—is identical to that in the right bank of the V-8.



COOLANT flows from the water pump to the cylinder block, up to the cylinder head, through the intake manifold, and back to the radiator.

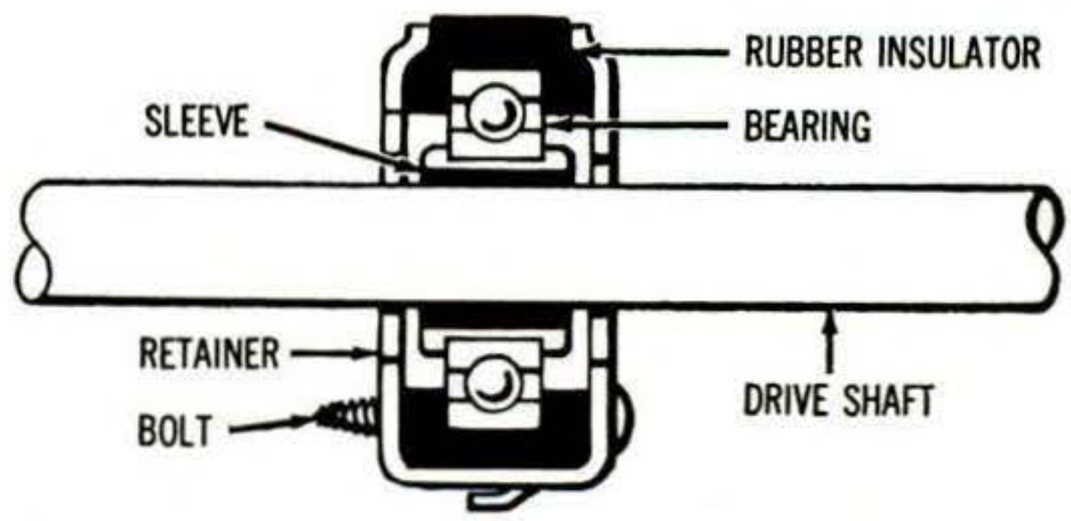
the spine of the unit-bodied Tempest.

Curving the shaft virtually eliminates the drive-tunnel hump inside the car, but that was just a welcome incidental. With a straight shaft, the rotating speed at which its natural frequency might cause vibration would fall within the shaft's normal operating speed. Curving it raises the natural vibration frequency above the highest speed at which the shaft must turn.

The shaft looks fragile, compared with conventional, tubular shafts with diameters of 2¼ inches or more.

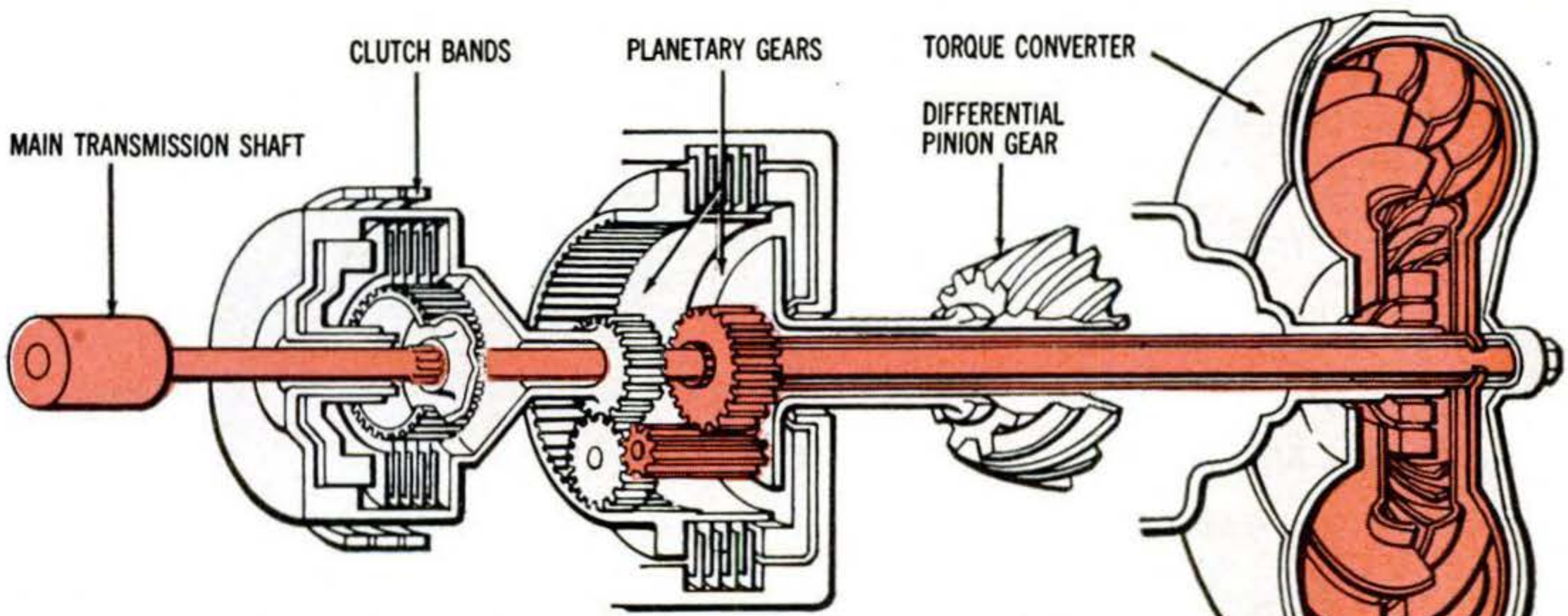
Pontiac, after four years of experimentation that led to the final design, says it isn't. The production shaft is a special alloy steel forging, heat-treated and shot-peened to resist fatigue. Two damper bearings fit inside the torque tube and clamp the shaft firmly in place to keep it from whipping.

The shaft transmits only the engine



TWO BALL BEARINGS like this support the drive shaft. They're encased in rubber insulators and are lubricated, then sealed for life.

torque. Conventional drive shafts working behind front-mounted transmissions must handle engine torque stepped up by the gearbox, so they are more heavily loaded. Shafts no bigger or sturdier than the Tempest's ⅝-incher (or ¾-incher, for the manual-shift Tempest) are used successfully to carry heavy torque loads in automobile transmissions, DeLorean reminded me.



TRANSMISSION SPLITS TORQUE: In high range, 40 percent goes directly to the mechanical gears through the front oil pump and clutch bands. The remaining 60 percent is multiplied by the converter.

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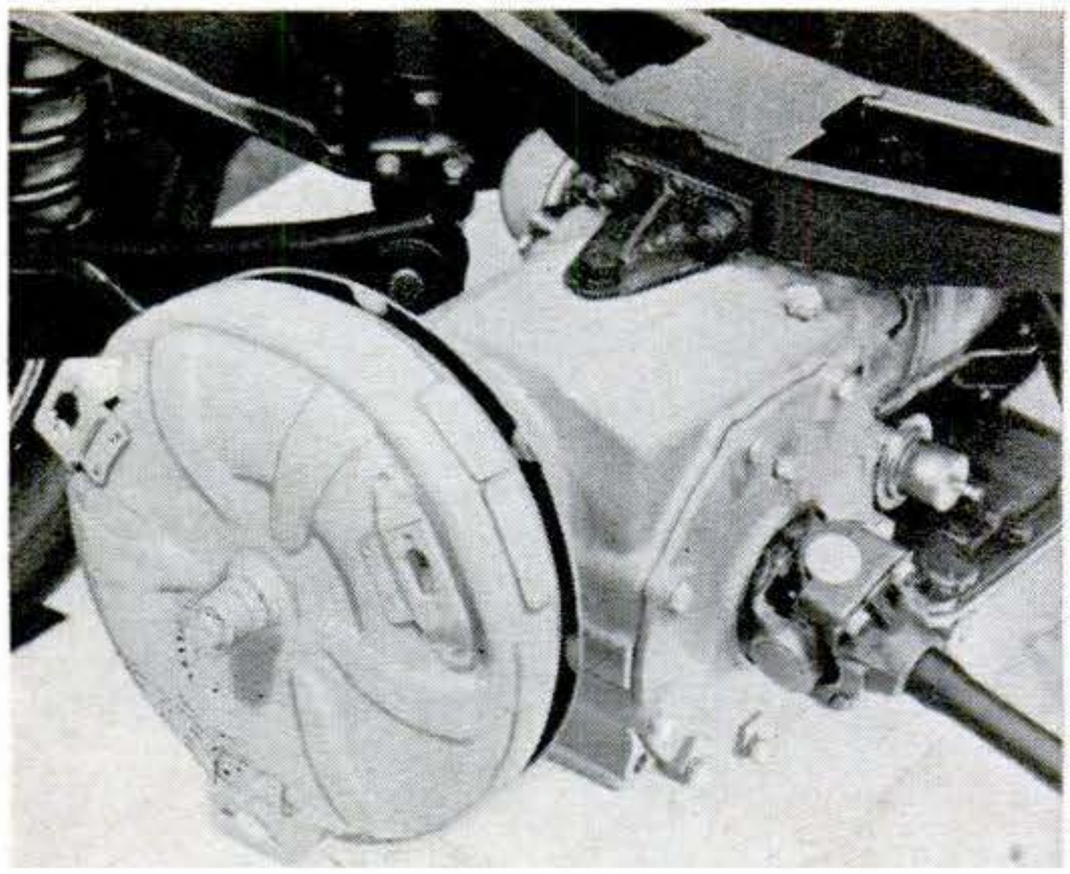

ROUND TORQUE-CONVERTER HOUSING hangs on back of differential in automatic-transmission Tempests. The front section of the transmission contains the gears, pumps, and clutch bands.

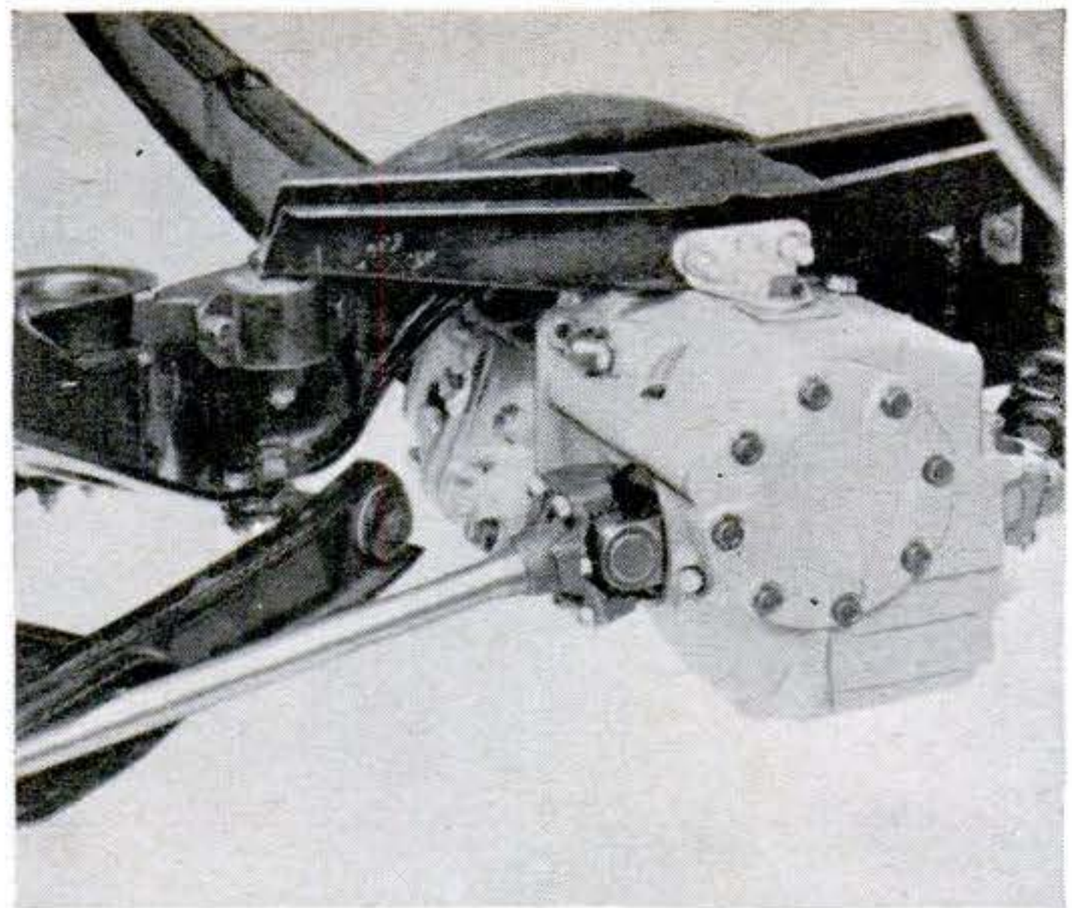

PLATE COVERS OPENING for torque converter on back of differential when manual transmission is used. Note how U joints, splined to differential gears, are attached to the swing axles.

glide rig) a "split-torque" transmission.

In low range, it works like any other torque-converter transmission. All the engine torque is fed to the converter, multiplied, and routed back through the planetary gearing to the differential.

In high range, the torque splits. About 40 percent goes directly through the mechanical gearing. The rest feeds into the torque converter. Splitting the torque offers these advantages:

- Greater efficiency. It cuts power-wasting (and gas-eating) slippage.
- Improved downhill braking. The engine helps brake the car because of its more direct connection with the wheels.
- More solid feel, less mushy response.

Separate lube supplies are needed for the automatic transmission and differential. The transmission takes a thin, low-viscosity oil; the differential gears demand thick, heavy grease. Since the transmission is split in two by the differential, engineers drilled a passage in the center of the main transmission shaft so oil could flow from the main transmission case to the torque converter. The oil returns through an annular passage between the pinion and turbine shafts—which nest concentrically around the main transmission shaft.

Since the three-speed transmission gets along on the same lube diet as the differential, they share a common supply.

On automatic-transmission models, the shift lever sticks out of the instrument panel. It controls the shift valve in the rear-mounted transmission through a flexible cable. In hand-shift jobs, the shift lever grows out of the floor. It changes gears through conventional linkage.

Pontiac credits the fully independent wheel suspension, plus the reduction in unsprung weight gained by hanging the transaxle on the body, with giving the under-2,900-lb. Tempest the ride of a bigger, heavier car.

Gobs of rubber sprinkled liberally through the suspension insulate the body from road shock and noise.

The Tempest has a wheelbase of 112 inches—two less than the Comet. It's 189.3 inches long—about the same as a Rambler Six—and 53½ inches high. Interior space is almost identical to the Falcon's, but the Tempest has an inch more rear head room and front hip room, plus 1½ inches more rear hip room.

And That's Not All—There's a V-8, Too

PONTIAC will offer an aluminum V-8 engine as an alternative to the Indianapolis Four in the upcoming Tempests. The optional engine will be the same 215-cu.-in. V-8 that will power the Buick Special and Olds F-85 compacts.

Except that it is smaller and made of aluminum, it will be much like the conventional, water-cooled V-8s in bigger cars. It will put out about 150 hp. and will be used with the same drive train as the standard four-cylinder engine.

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How to climb a pole

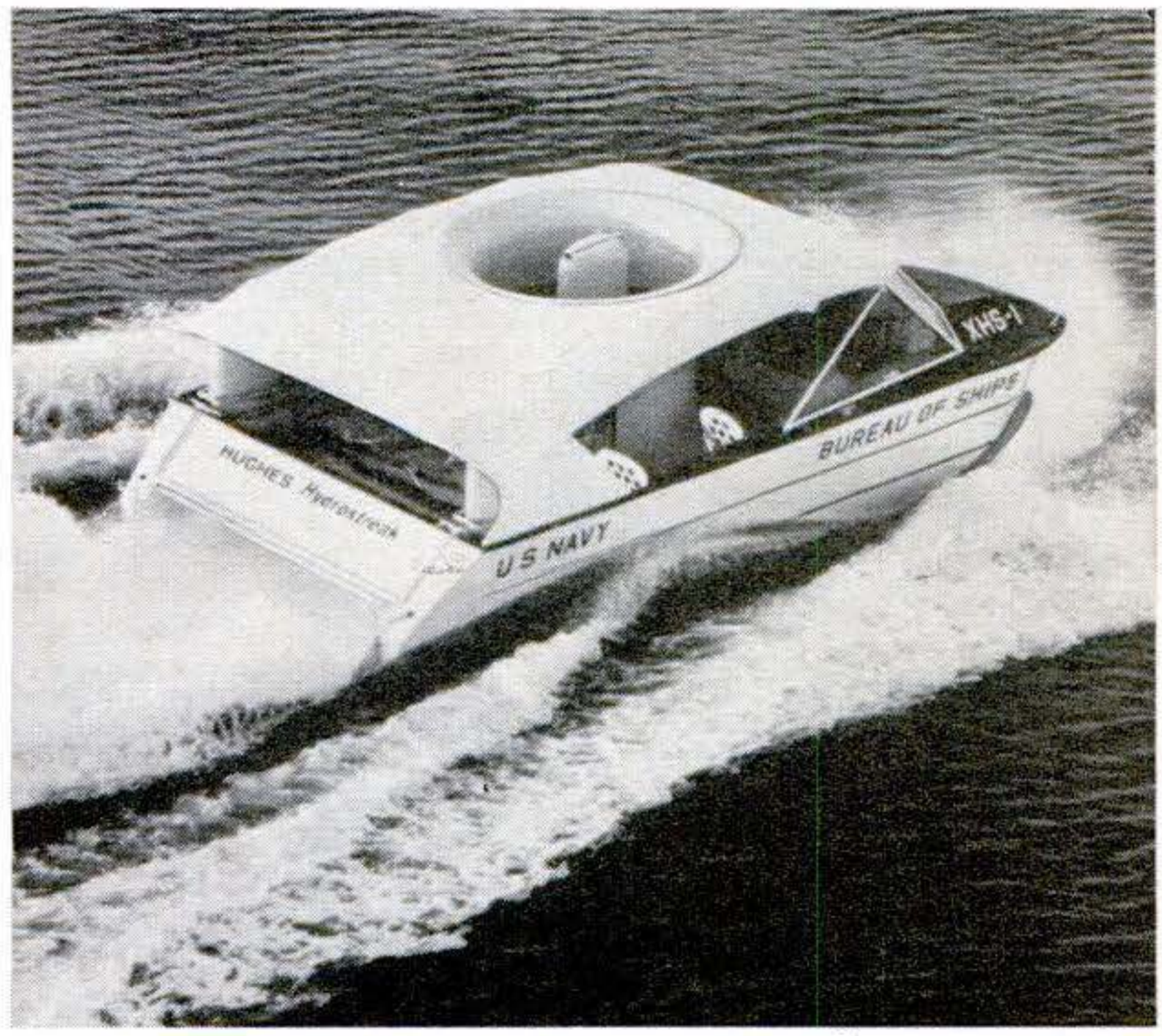
With his feet strapped in this device, a lineman should have no trouble climbing a power pole, or a logger a tall tree.

As he lifts his lower foot, the attached band loosens its hold on the pole and rides up with ease, then grips it tight again as he puts his weight on it to raise the other foot. The device is a Swiss invention. It's shown here at a fair in Bath, England.

Little red radio wagon

Surveyors helping to build a dock at Monterey, Calif., use what may be the world's smallest mobile radio units. They are mounted, with battery and antenna, on children's wagons.

The surveyor above transmits data from his transit to the pile-driver barge in the background. Another, also with a radio wagon, gives similar help from the wharf at far right.

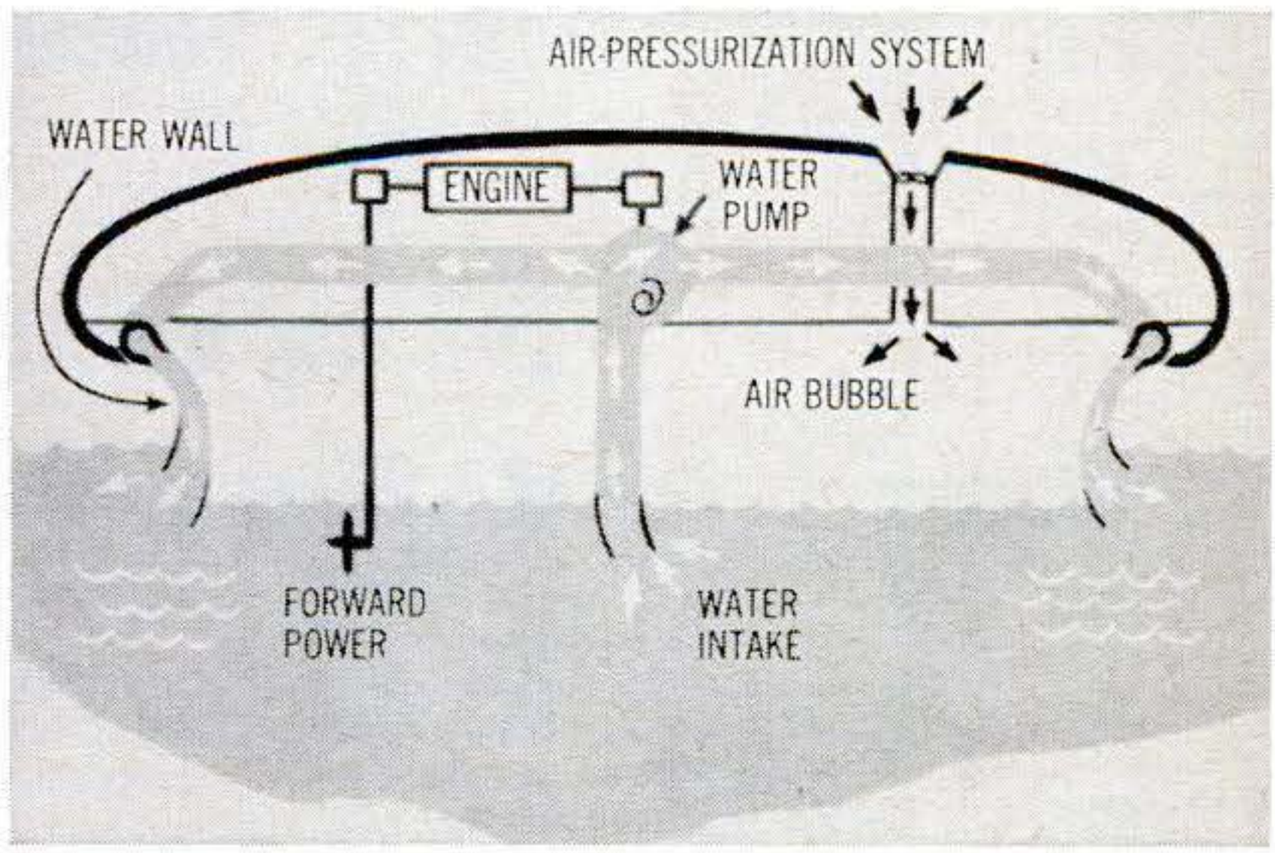


HYDROSTREAK PROTOTYPE rides on a bubble of air that is held captive in a pocket formed by side fins and two walls of water gushing from nozzles at prow and stem.

Water-wall speedboat

The Navy is testing a new kind of boat that travels on a pocket of air. Unlike ground-effect vehicles [PS, July '59 and Jan. '60], which also ride on an air cushion on water or land, this craft digs a hole, seals it off with a thin wall of water, pumps in an air bubble two feet high, and is propelled both by the angle of the spouting water and a propeller extending below.

How it works is shown below. Water is scooped up and pumped with force fore and aft to create an enclosure in combination with two deep side fins. Air sucked from above by a powerful fan is compressed and expelled into this pocket from which it can't escape. Hughes Aircraft Division developed the idea for the Bureau of Ships, built and tested a 21-foot craft, has plans for other sizes.



SECTIONAL VIEW shows the operating principle. The boat is lifted above the waves on an air cushion produced by a blower and held under it by spouting water walls.

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TOP HAT "LOADS" VERTICAL ELEMENT

980-FT. CENTRAL TOWER

1" BRONZE WIRE

OFFICES AND SHORT-WAVE TRANSMITTERS

HELIX HOUSE

TRANSMITTER BUILDING

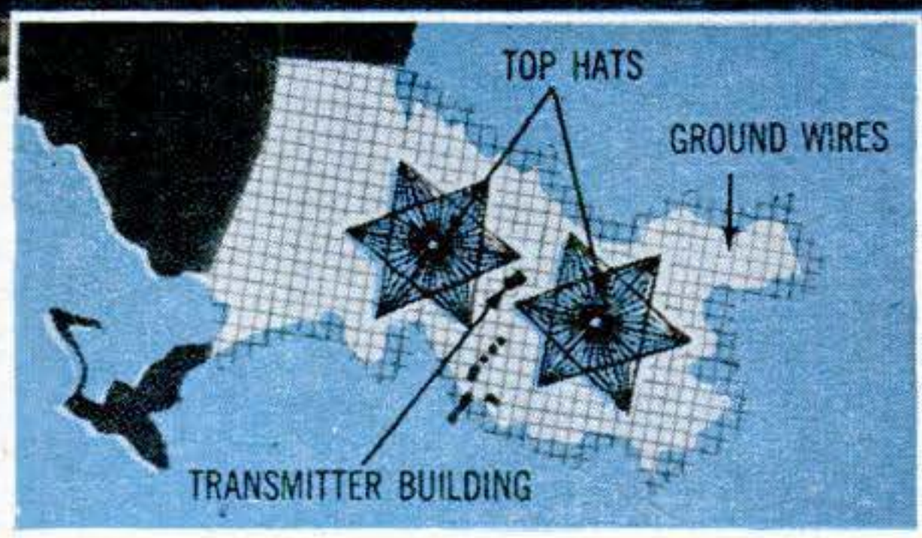
PIER

TANKS STORE 20,000 BARRELS OF FUEL

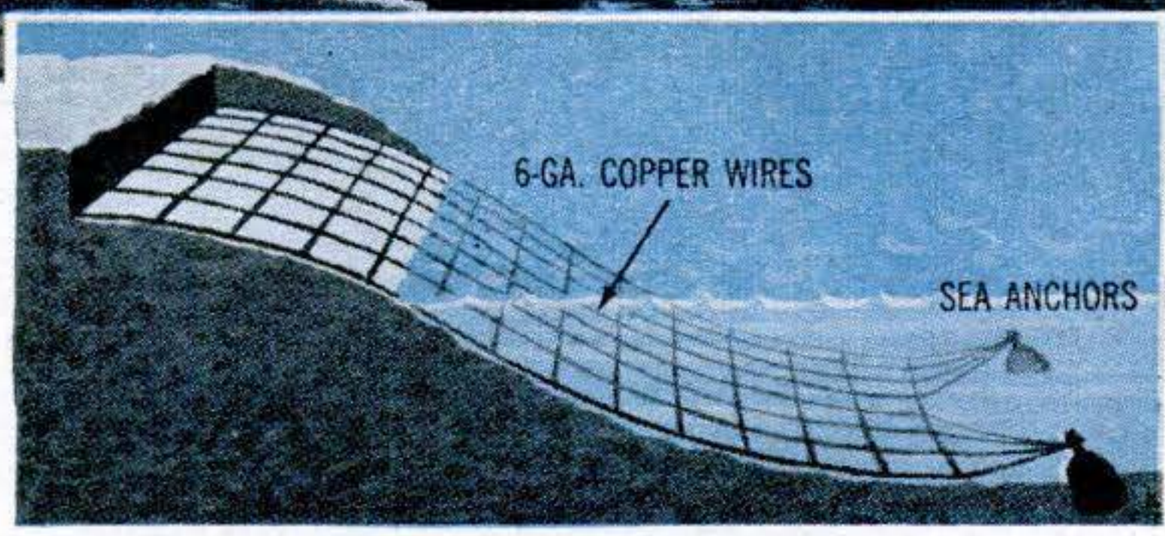
DIESEL-DRIVEN POWER GENERATORS SUPPLY 11,000 KW. (ENOUGH FOR CITY OF BANGOR)

MACHIAS BAY

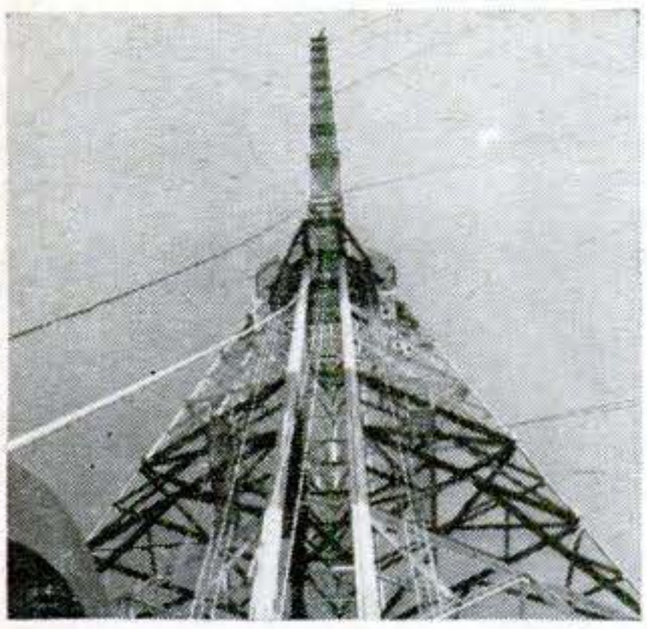
EXTRA-HEAVY FUEL OIL SUPPLIED BY TANKER



STAR-SHAPED TOP HAT for each antenna covers area big enough for 11 Pentagons.



BURIED COPPER NET—electrical ground for antennas —underlies most of peninsula, trails off into sea.



SKINNY AND TALL, towers soar as high as 980 feet.

Navy Builds World's Most Powerful Transmitter

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DE-ICING CIRCUITS CAN MELT 2" ICE IN HALF-HOUR

SIX 875-FT. INNER TOWERS

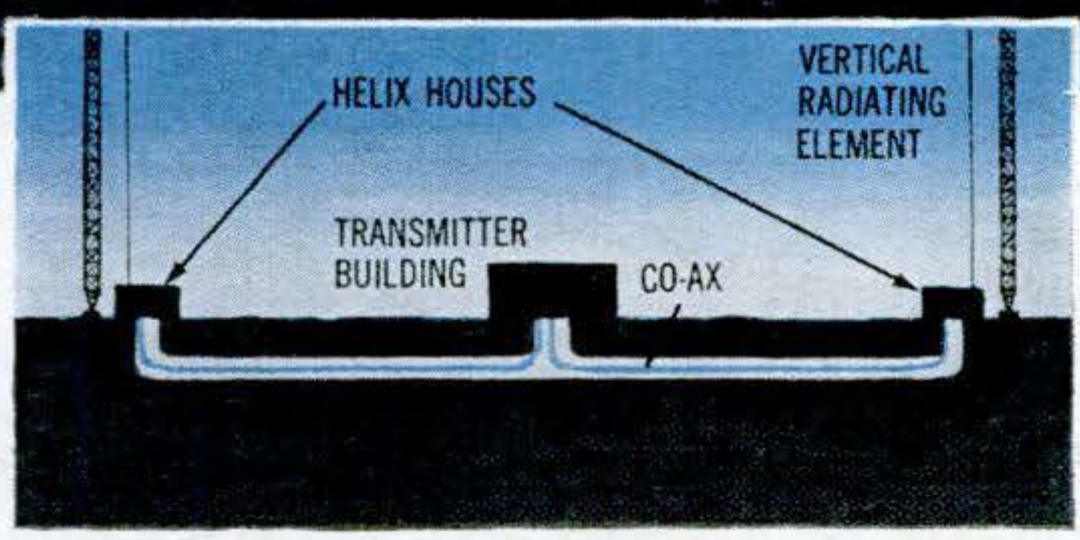
SIX 800-FT. OUTER TOWERS

WASHINGTON MONUMENT: SAME SCALE

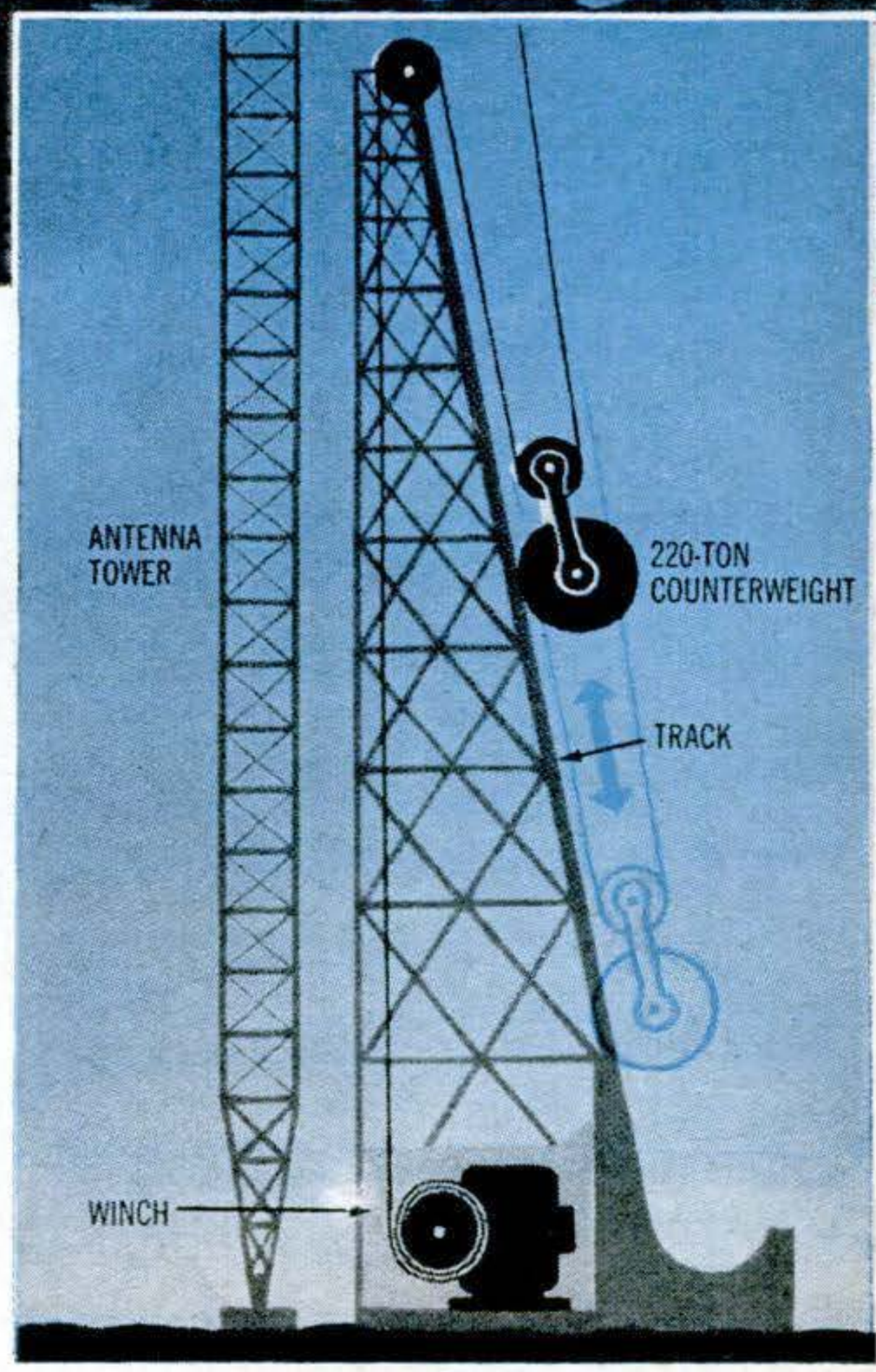
LITTLE MACHIAS BAY

SINGLE VERTICAL WIRE BROADCASTS WAVES

CROSS ISLAND NARROWS



TUNNELS A MAN CAN WALK THROUGH hold huge co-ax feeding transmitter output to antennas.



COUNTERWEIGHTS, riding track, keep antenna cables aloft, compensate for sway in wind.

A 2,000,000-watt radio station will achieve the "impossible": signaling U.S. subs underwater

By Martin Mann

A FANTASTIC spider web covers an entire peninsula at the easternmost tip of Maine—715 acres of bronze lace 800 feet and more above ground. This is the antenna for the most powerful radio broadcasting station ever built.

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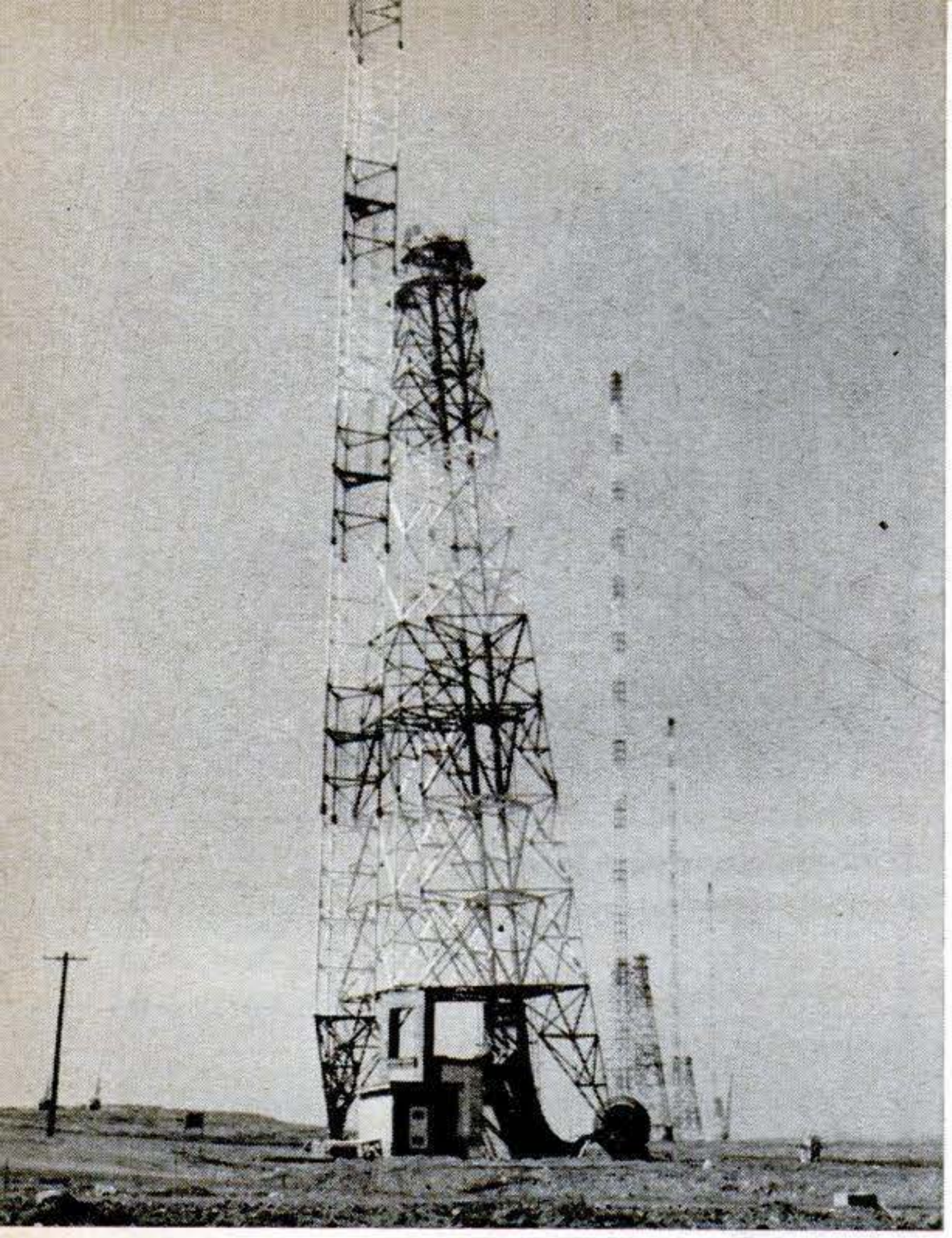
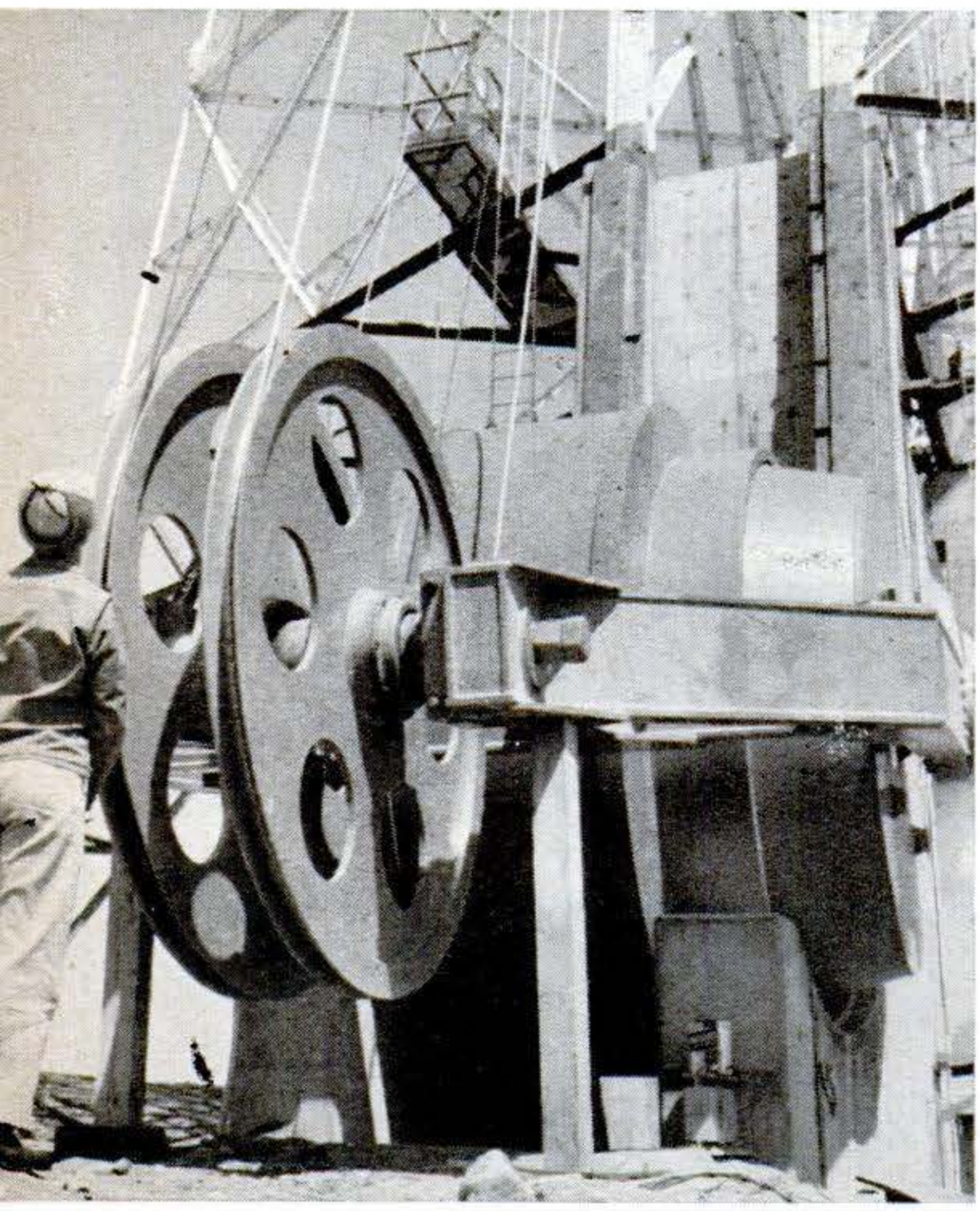


TRIANGULAR TOWER rests on a single point at its bottom, is steadied by guy wires. Shorter conical tower at side is "roller coaster" track on which wheel-like counterweight rolls.



GIGANTIC COUNTERWEIGHT—220 tons—is filled with special dense cement. When the antenna is up, it hangs from double sheave, the cables running to the antenna above and winch below.

Its purpose: to talk to submarines—*underwater.*

From that lonely finger of land, radio signals of unprecedented strength can reach every corner of the earth. They fit the final piece into the surest weapon in the U. S. Navy's arsenal (in any arsenal, the Navy claims). The weapon is a complex:

- The H-bomb. . .
- Delivered by the Polaris missile—medium range, solid-fueled. . .
- Fired from beneath the sea by an atomic-engined submarine.

A-subs can cruise many months submerged. (Recently one went clear around the world without surfacing.) Underwater they are virtually impossible to detect.

The whole system is an unparalleled defense of retaliation—mobile, invisible. It could not be knocked out by unwarned attack, as might land-based intercontinental missiles—their huge launching sites are sitting ducks, too big to be concealed or even kept secret.

The trigger for this potent weapon is the new radio station NAA. Only its tremendous power (2,000,000 watts, 40 times the output of the biggest broadcasting transmitter) and unusually long waves (20 or more times the length of standard AM broadcasts) can dit-dah-dit-dah through seawater to the submerged sub fleet. Should Doomsday come, only it can tell our quiet pickets under the sea, "Go there . . . and press the button."

Ordinary radio signals cannot penetrate water. Until NAA goes on the air early next year, submarines must raise their antennas above the ocean surface to receive messages. Surfaced, even by so little, they are vulnerable. Radar or just a sharp-eyed lookout can spot them, and the key advantage of the Polaris-armed A-sub is lost.

Tourist attraction. From the road, you can tell that this radio station is something special. It lies right beside route 191, a few miles off the tourists' U.S. 1. Across Little Machias Bay, you see the whole peninsula, 2,850 acres stripped of scraggly pines and bulldozed level to sprout 26 sky-piercing towers, straight as giant pencils. Two climb 980 feet. That's nearly twice the height of the Washington Monument.

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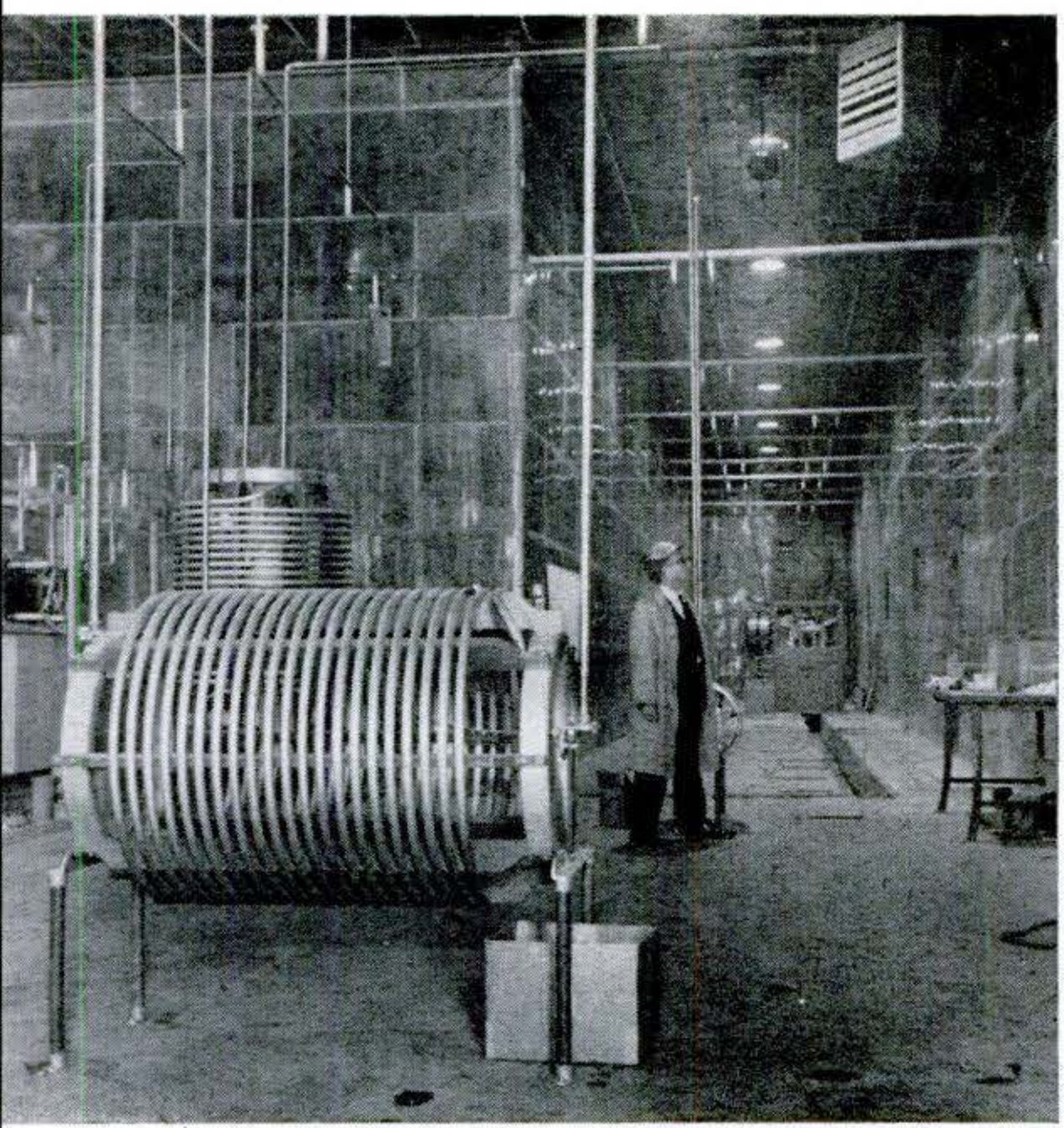
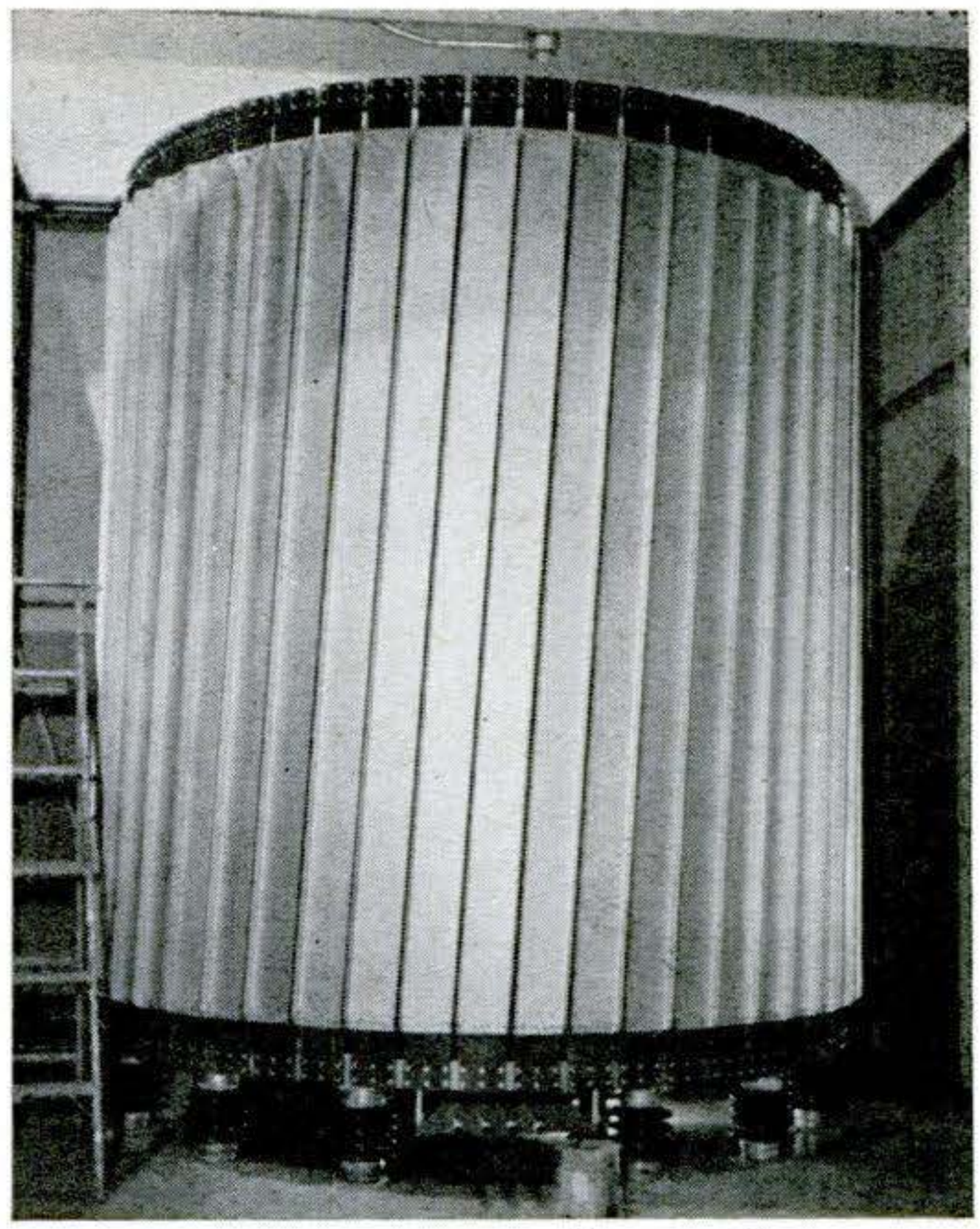


MAD-SCIENTIST RIGS in copper-lined room transfer powerful signal from transmitter (on other side of right-hand wall) to antenna lead. No one can be here when station is on the air.



OUTPUT TRANSFORMER—twice as tall as a man—typifies over-size equipment. It is new "toroid" type with slanting copper strips corresponding to the coils of an ordinary transformer.

The great steel spires support two complex antennas that work together or separately. In each "array," the antenna proper (the part that sends out radio waves) is a single cable running straight up from the ground. To work best, it should stretch up at least one-fourth the length of the waves it transmits. That would come to five miles.

No towers go that high. So a shorter antenna element (about 900 feet) is fooled electrically into acting as though it reached the correct quarter-wavelength. This is the job of the vast web of cables draped over the towers. This "top hat" stretches more than a mile from side to side; you could nestle 11 Pentagon buildings underneath. It is fastened only to the center tower. The edge cables run free over pulleys to gigantic counterweights—220-ton wheels that ride on roller-coaster tracks. In a high wind (172 m.p.h. is bearable), the swinging cables will jig those cement-packed wheels 200 feet up and down.

NAA's giant condenser. The top-hat web is not the antenna proper—it does not broadcast radio waves—but serves as one plate of the biggest electrical condenser ever made. The other plate of the condenser is the earth, more than 800 feet below. Together, they "load" the vertical broadcasting element, which stretches between them, so that it works efficiently. About half the electrical energy supplied the two antenna arrays gets out as signal—one million watts of radiated power. If that were 60-cycle AC, it could light up

[Continued on page 240]

TO BURY GROUND WIRES, bulldozer was adapted to plow furrow and lay the heavy wire in it, all in one operation. Wires are buried mainly to protect them from accidental damage.

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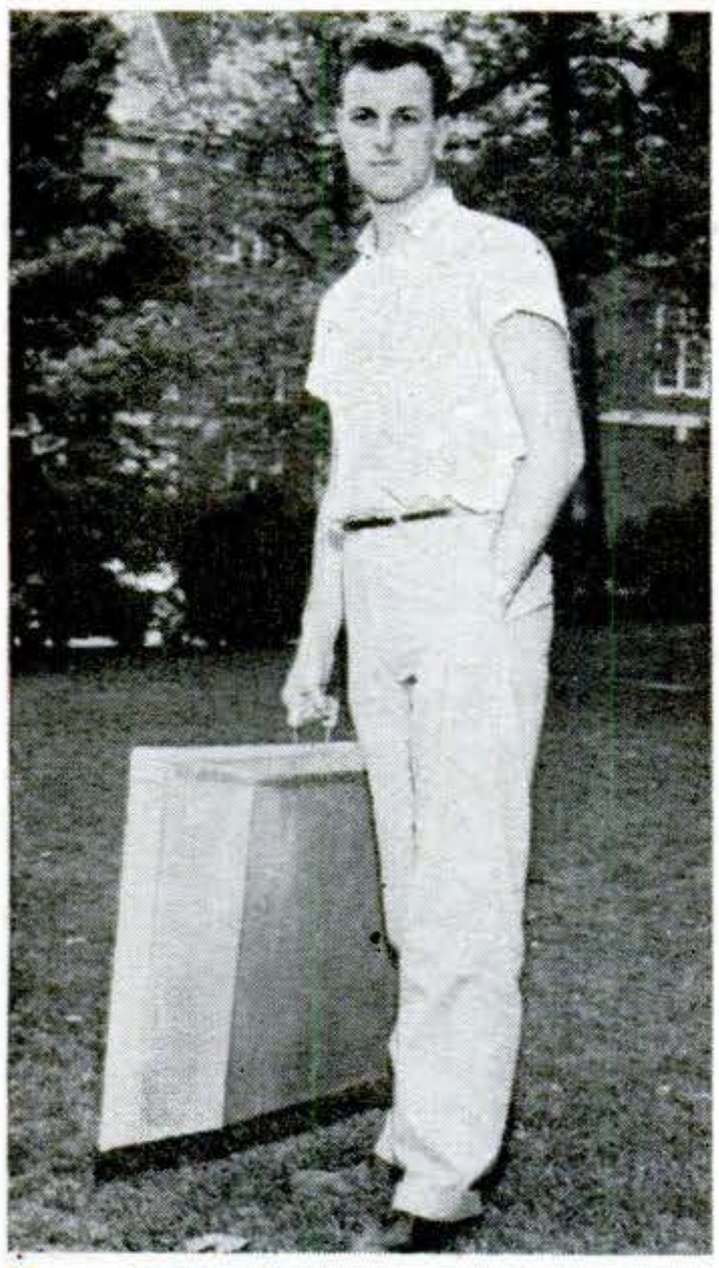
OFF WITH A BEEP: A radio-equipped ruffed grouse is set free after momentary captivity during which he was outfitted with a tiny transmitter that gives human eavesdroppers a line on his daily habits.

CLOSE-UP OF TRANSMITTER: Battery is in the tubular section at top, four transistors and circuitry in the box. The antenna extends below the unit.

Radio beeps keep track of grouse

A ruffed-grouse version of the GIs' famous World War II walkie-talkie doesn't talk—it beeps. Minneapolis-Honeywell developed it for University of Minnesota wildlife researchers to keep track of the living and mating habits of game birds.

The instrument, a miniature transmitter weighing 1½ ounces, straps to a bird's back. Its battery is good for 40 days, and a thin antenna flexes as the



Boat folds into carrying case.

It holds one person sitting crosslegged—with room for bait.

Collapsible boat made of aluminum

This fishing boat was built of aluminum by John Thomson, a University of Illinois industrial-design senior. It folds into a compact portable pack no larger than a fair-sized suitcase. Paddles, cushion, seat, and backrest go inside, bringing the weight to just 30 pounds. Thomson designed the boat as a class project.

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MINIATURE RADIO STATION is harnessed to back of captive bird before he is set free. It weighs 1½ ounces, contains a 40-day battery.

HERE'S HOW BIRD IS CAUGHT: Mirror at back of trap makes him think an enemy has invaded his domain. He attacks. Door springs shut.

grouse walks in heavy underbrush and under low-lying branches.

A two-mile-range beep is transmitted once a second to the bird hearers. Two receiving stations can tell by triangulation how far and where a grouse strays: from his nesting ground to feed, when weather changes, and even, maybe, to find a new temporary mate.

Researchers have equipped six male grouse with flyie-beepies. Elsewhere, South Dakota scientists may use the rig to study deer, and in Montana the system may be tried on grizzly bears.

Here's a tall story

Two big performers get better acquainted here at a circus in Northern Ireland when a giraffe gives a straddle truck the once-over. The carrier, made by Short Bros. & Harland, Belfast, hauls awkward equipment slung between its legs.

He rides to work

When 10-year-old Richard Bregan grew tired of pushing his father's power mower at his home in Bookham, England, he converted it to a sulky. He rigged up a baby carriage behind it and fitted on an empty nail keg for a seat.

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Everest's Conqueror Tracks Abominable

Hillary hunts the unknown animal that leaves the world's most mysterious footprints

By Gardner Soule

THE most experienced Himalayan expedition ever to pursue the Abominable Snowman takes up the chase this month under Sir Edmund Hillary, the man who conquered Mount Everest.

"I'm keen to find out if the creature exists," Hillary told me a few weeks before he set out. "I'd like to examine it—it may be a missing link."

Hillary, who followed up his Everest expedition of 1953 with an overland trek to the South Pole in 1957-8, is well aware that the Snowman may prove his most difficult triumph. Though men by now have entered most Himalayan valleys, and though they frequently find big man-like footprints in the Himalayan snows, they rarely glimpse a Yeti, as the natives call the Snowman. When they do, they

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Snowman

see little more than a wraithlike shadow. The animal has thus remained uncaptured—and one of the major mysteries of zoology.

"We'll be extremely fortunate to be in the right place at the right time to find one," says Hillary. But he counts heavily on something no other expedition has ever had: plenty of time. He'll search the Mount Everest area four months for the Snowman, and he can continue for five months more—as seven of his men will winter in the high Himalayas and his party, next spring, will attempt to climb nearby Mount Makalu.

To stay out four to nine months, and over the frigid Himalayan winter, requires new and improved provisions and equipment—better shelter, more-appetizing food (and more of it), and warmer clothing.

Clothing. Underwear will have four layers. Long johns will have a layer of cotton next to the skin, one of wool and cotton, one of plastic-foam insulation, lastly an outer layer of nylon knit. There are air spaces between all layers. Down-padded pants and jackets and windproof parkas will be outer clothing. On their climbing boots, Hillary's men will wear overboots—a sort of huge, padded sock.

Shelter. The highest home on record will house the expedition men who winter over. At 20,000 feet, they'll be at the highest point where men have ever passed the winter. They'll live in a prefab, Quonset-like house 10 feet long by 20 feet wide. Its aluminum-and-insulation panels were built four-by-two feet in size—so the expedition could carry them in. "We'll erect it on an exposed saddle of

HUNTER AND QUARRY: Sir Edmund Hillary, wearing high-altitude mitts, holds sketch of Abominable Snowman. The drawing, based on one in Bernard Heuvelmans' book *On the Track of Unknown Animals,* was made from best evidence of its appearance. Snowman's mysterious footprints in Himalayan snow are shown at right.

CONTINUED

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snow and ice," Hillary said, "and anchor it to 'dead men'—canvas kit bags filled with snow."

Down lower, another hut will be built of tree branches, wire netting, and tar paper. This one will be complete with fireplace. For temporary use, high-altitude tents and draw-tight Himalayan tents will be used.

Besides watching for the Snowman, the wintering-over party will study the effects of high altitude on the human body—a major purpose of Hillary's expedition.

Food. At below-zero heights, where men must eat ravenously to keep going, Himalayan explorers for decades have been plagued by diminishing appetites. "When you climb to high altitudes," Hillary says, "you need something to titillate your appetite. A can of apricots appealed to me at 28,000 feet."

The research laboratory of an American firm (Armour) has developed a new kind of food that the expedition will eat. It's produced by "freeze-drying"—a process that removes 98 percent of the moisture from frozen food without thawing it. The food can then be kept, wrapped in aluminum foil, at any temperature. Removing the moisture reduces the weight: A hundred pounds of fresh meat, freeze-dried, weighs 20 to 30 pounds. Two-thirds of Hillary's 18-ton load will be food.

To prepare these foods for eating, you dunk them in water. In a short time (a steak takes 20 minutes) they pick up the water lost in freeze-drying and are ready to cook. The soaking restores the food to approximately original color, shape, and taste.

In Chicago I sat down with Hillary and others of his party and sampled his forthcoming freeze-dried Christmas dinner: shrimp (in a cocktail), Salisbury steak, French green beans, and glazed apple slices for dessert. "This is very tasty food," Hillary commented. I agreed. Other freeze-dried foods he'll have along: lamb chops, chicken, ham, steaks, carrots, and mixed meat and vegetables for stew.

Besides allowing enough time for the job, Hillary is giving his team every possible advantage:

- He's picked the best time. In fall and winter, the Snowman is believed to come down from the greatest heights. It's possible that it does so in search of food: mouse hares (a kind of rat) and plants that grow below the tree line.

Almost all other Himalayan expeditions have set out in the spring. But Hillary thinks winter may actually help him. "There may be lots of fine weather between blizzards," he says, "and hard snow surfaces we can work on."

- He's selected the most promising place. In the Menlung Valley near Ever-

FAMOUS MOUNTAINEER Sir Eric Shipton, who took photos of Snowman's footprints (including one on previous page), will be with Hillary.

CHECKING FIELD RADIO are Michael Gill, left, of New Zealand; Marlin Perkins, right, of the Chicago zoo. Hillary is sitting between them.

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SOFT OUTER BOOTS for climbing will not clatter on rocks or ice. Expedition will be most silent ever—to avoid frightening away Snowman.

LIGHTWEIGHT FOOD is freeze-dried. Small chunk of beef (right, and in wrapper above) becomes plate-filling slice when water is added.

HIMALAYAN TENT, pitched atop Chicago's Merchandise Mart, holds Hillary, Perkins, Barry Bishop (an expedition glacier expert), and Gill.

est, according to the World Book Encyclopedia, sponsor of the expedition, many Snowman footprints have been seen over the years. Hillary will stretch his men out over the valley. "We'll have a base camp," he explains. "Then we'll set up a string of three lookout posts, each 17,000 to 19,000 feet up. Each lookout post will have one or two Britishers or Americans plus two or more native guides—Sherpas. They'll keep in close touch by radio.

"If men at a lookout post sight something—tracks or a Snowman—they'll radio us at the base camp, and we can then concentrate our efforts on their area."

But the base camp can't answer a call like a fire department rushing to a blaze. "It'll take us maybe two days to reach a lookout post," Hillary says. "Meanwhile, the men there will have to carry out their own search, photograph the tracks before they deteriorate, and do all they can to identify the Snowman."

● He may use a "capture" gun. This weapon uses compressed carbon dioxide to shoot a hypodermic syringe as far as 100 yards. Hillary would like to render the Snowman unconscious at least long enough to find out what it is. If there's a chance to bring it down from the mountains, the men will construct a cage of wood and wire netting.

● His secret weapon is silence. "We think the animal has much keener hearing than ours," he says. "Human noises frighten it away. We've found by experience that if you hit the steel of an ice axe against a rock, you can hear it for considerable distances. So we'll enter the region, not by the Menlung Valley, but instead by the next-door Rolwaling Valley. Then we'll tiptoe through passes into the Menlung."

● Above all, he is counting on the experience of his topflight team. Their names read like a Who's Who of Himalayan mountaineering, and include: Dr. Griffiths Pugh, an old Everest hand;

[Continued on page 258]

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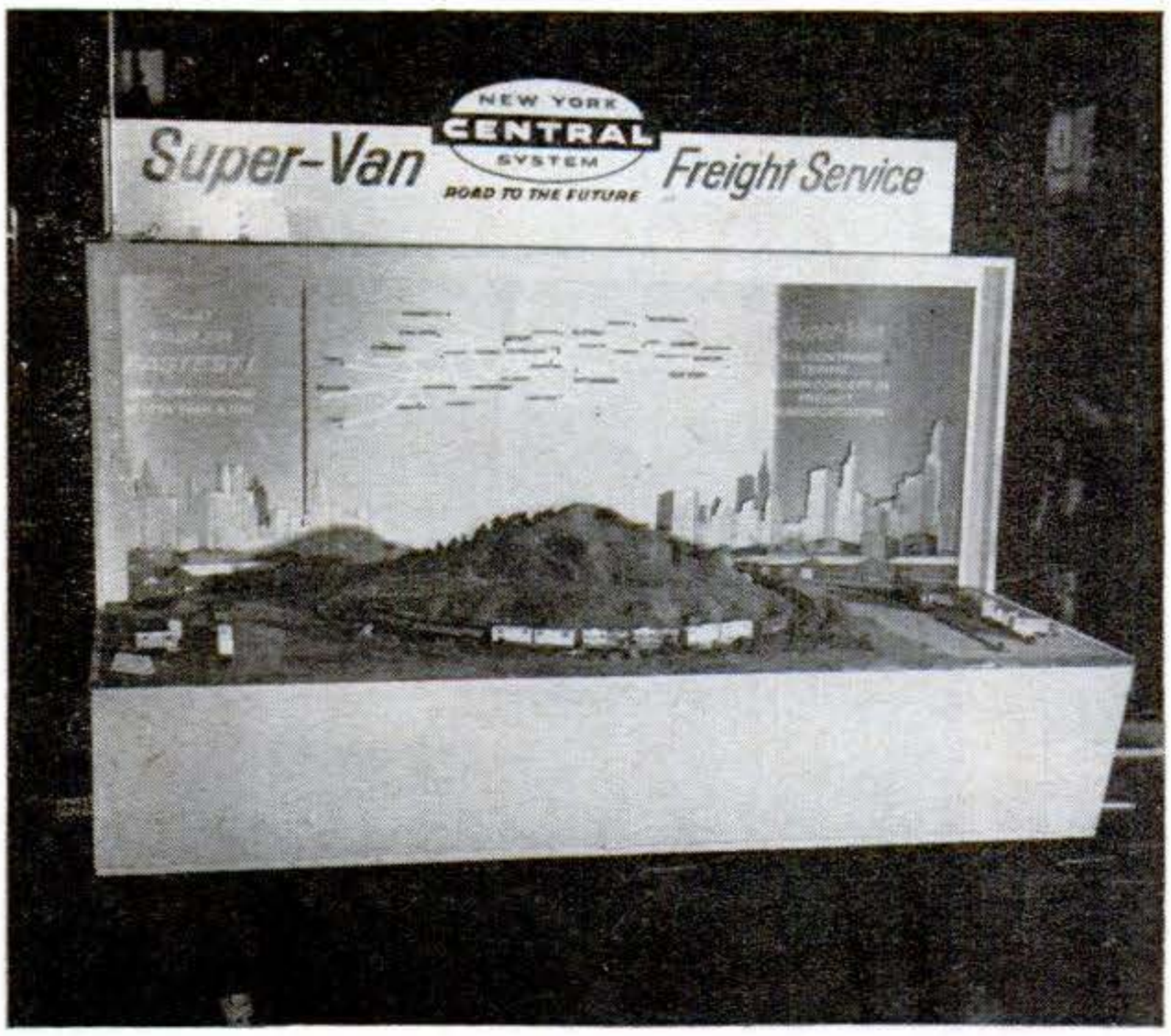
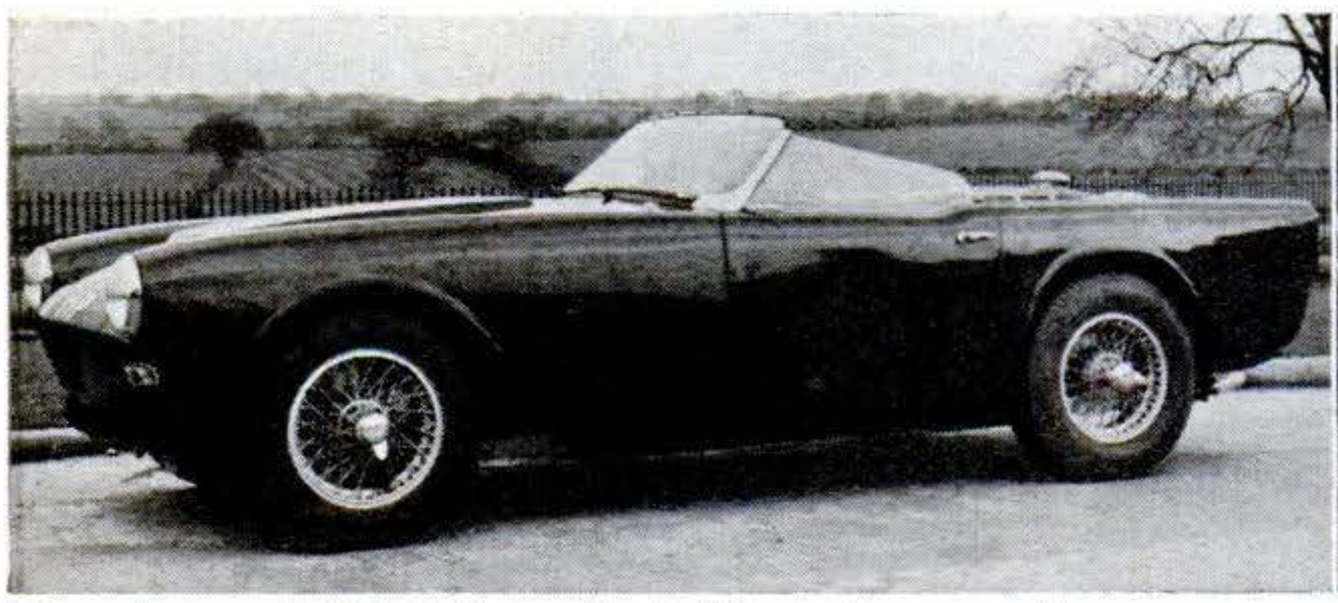


Another train goes nowhere

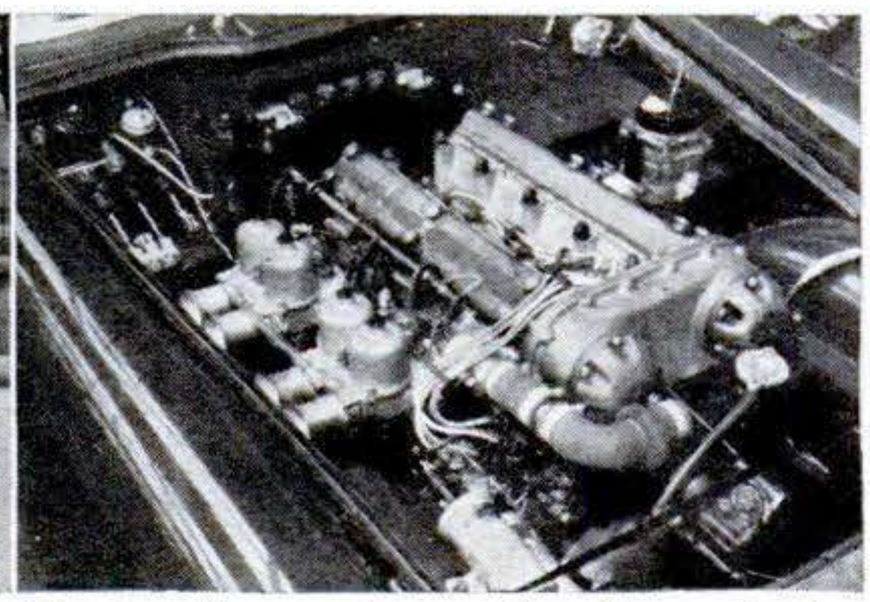
Inspiration for this train display by the New York Central in its Grand Central Terminal in New York came from an article in April PS: "The Speeding Train that Goes Nowhere."

Carlton Bucher, who did the article for PS, built this version for the railroad to demonstrate its Flexi-Van freight service at stations on its system.

It employs the same principle —an HO-gauge train running on a track on the rim of an unpowered but slightly tilted wheel. This model uses a larger wheel from a racing bike to support a four-foot layout.



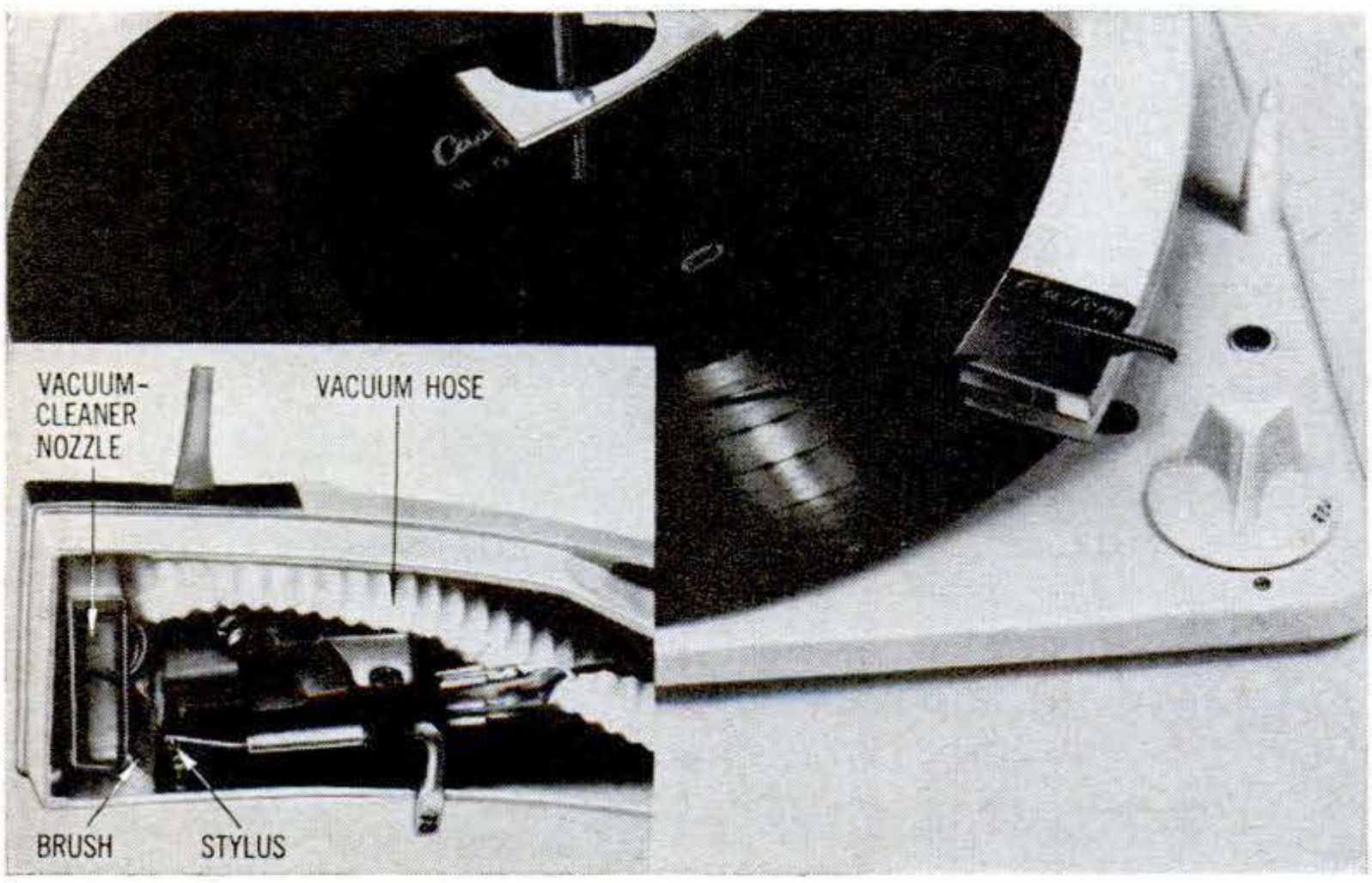
Experimental TR-S is a sleek fiber-glass number.



Engine has twin overhead camshafts.

Sporty newcomer

Standard-Triumph is making a new sports car, the TR-S, that may succeed the popular TR-3. The experimental prototype above is powered by a light-alloy, twin-overhead-camshaft, 121-cubic-inch engine that develops 125 hp. Design of the four-cylinder engine is square. It has a 9.25:1 compression ratio, four S.U. carburetors, and a four-branch exhaust. All wheels have Girling disk brakes.



Vacuums as it plays

The new pickup arm at left vacuum-cleans the grooves in recordings while they are played.

It consists of an acoustically sealed vacuum cleaner that picks up dust on a brush in front of the stylus and carries it through a tube to a container. GE puts its Vacu-Magic on two of its more expensive consoles.

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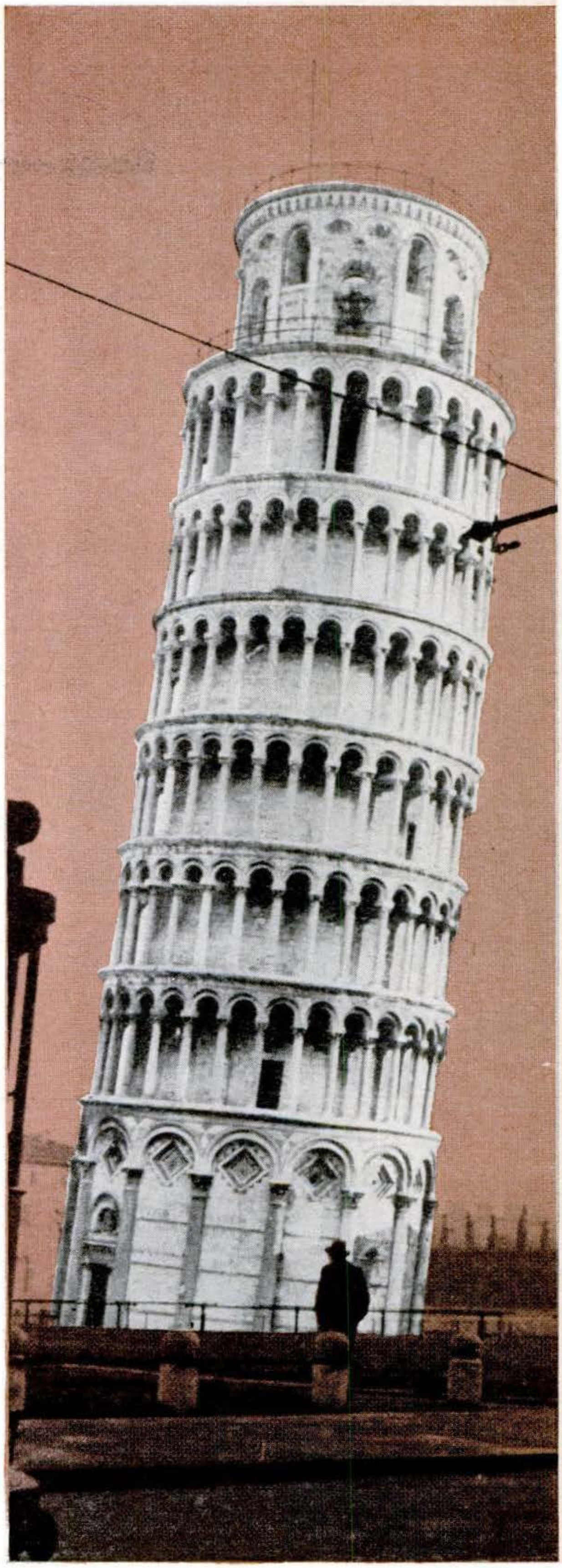
The Leaning Tower Is Falling Down

Now 17 feet out of line, the 800-year-old wonder may collapse before long

By Joan Steen

PISA'S famous tower will fall—unless someone quickly thinks of a way to save it. Come up with a workable plan that the experts haven't thought of and the Italian government may well lavish upon you undying thanks, honorary Pisan citizenship, and fistfuls of lire.

It won't be easy. The 179-foot tower is already 17 feet out of kilter and shows alarming signs of gallop-



FAMOUS BELL TOWER at Pisa, begun in 1174, was finished two centuries later. Now its bells no longer toll the hours: Their vibrations might be fatal.

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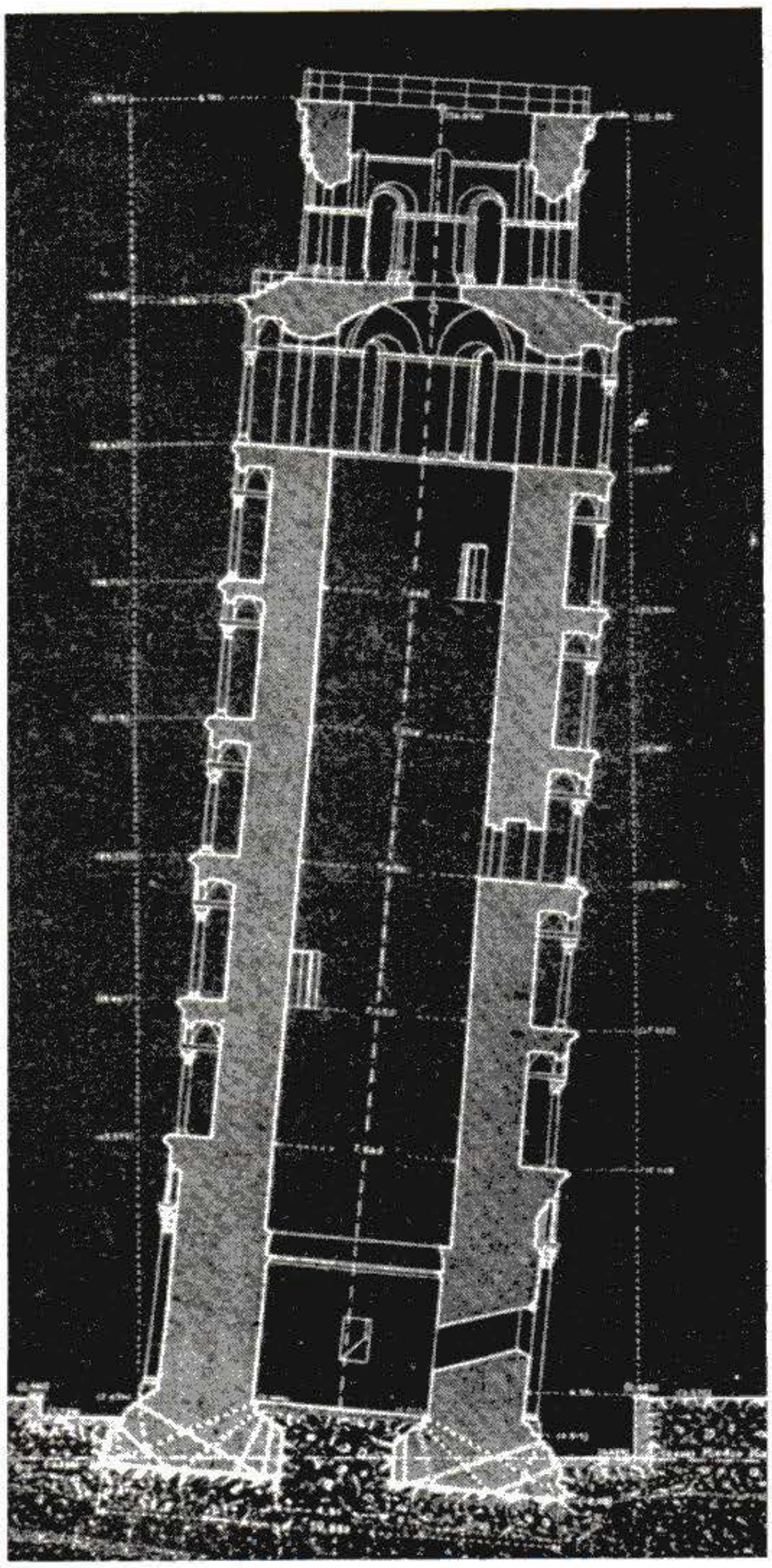
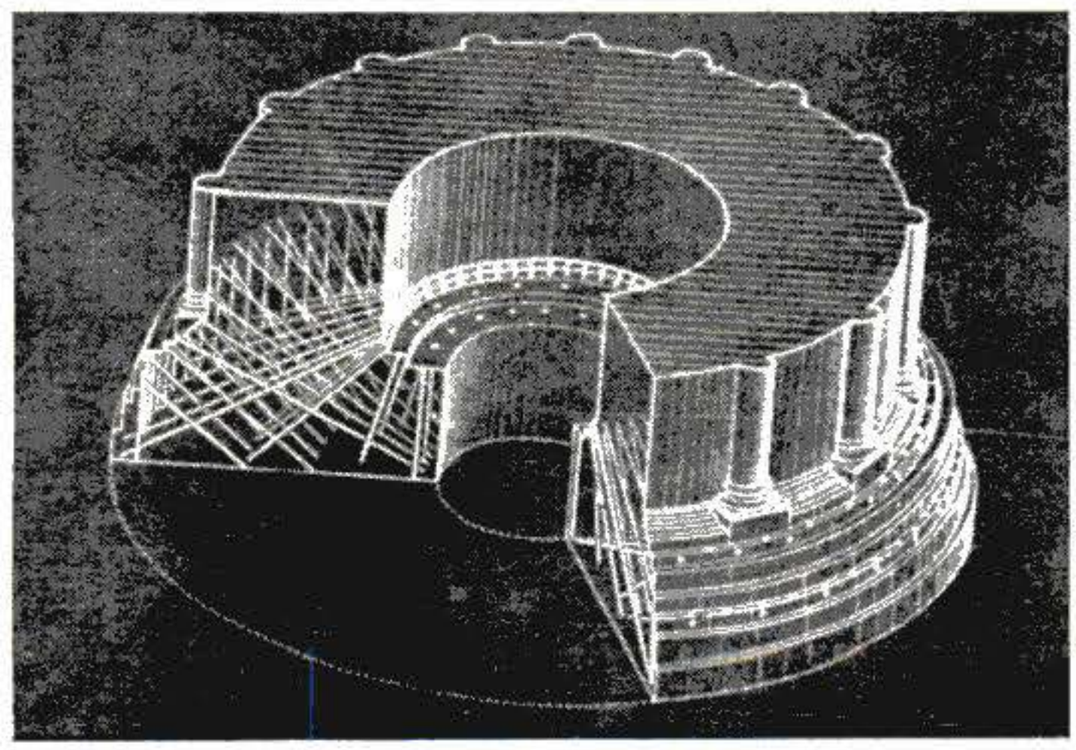


CROOKED TOWER'S CROOKED SPINE shows up in the cutaway drawing. Hold a straightedge against the central axis. Slight jogs in the line appear at the three-story and belfry levels.



REINFORCED FOUNDATION was not strong enough to resist the effects of Pisa's marshy soil.

ing to its death. The lean has been accelerating. Once 0.04 inch a year, it's now up to 0.06 inch. How much longer this can go on before the tower reaches the tilt of no return authorities shudder to predict. Some think it won't last another generation.

Shhhh! Meanwhile scientists quietly bedside-watch the decline of their patient. They've installed seismographs and an inclinometer inside the tower to record the changes. They've silenced the tower bells and banished cars and motor scooters from the surrounding plaza, lest noisy vibrations set up fatal shiverings.

Years ago the scientists operated. To shore up the sandy foundation blamed for the tower's troubles, they drained rain water from the low side and injected 93 tons of concrete.

This seemed to work for a while. Then in World War II a stray shell fired during the Battle of the Arno damaged part of the tower's upper level. New shakes set in and started the tower's slow-motion leaning again.

Early inclinations. The 800-year-old tower began life with a lean. Bonanno Pisano, who designed it and began construction in 1174, was more artist than engineer. When the first few floors showed leaning tendencies, he decided to fix things by making the next few tend a little in the opposite direction. No one, thought Bonanno, would ever know of his improvisation.

But the city fathers did, and fired Bonanno. Work was picked up a century later by a hunchback, Giovanni di Simone. By this time the tower was 10 inches out of plumb, so Giovanni added his three stories at a compensating angle, too. He quit under pressure of critics who said they could do without a hunchback tower.

The finishing touches waited another century to be put on, this time by an unknown architect. Presumably neither hunchback nor near-sighted, he nonetheless didn't match the diameter of the rest of the building when he added the smaller belfry.

Falling bodies. That same belfry attracted Galileo two centuries later. In 1589 he climbed the winding staircase to the top to test his theories on the velocities of free-falling objects. He

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dropped differently weighted balls over the side.

That might be reason enough for the tower's fame had it not already been a tourist favorite. The tower's tipsy beauty has been the city's chief drawing card for centuries, although other Pisan buildings are known to show a certain lack of plumbness, too (proof possibly that the lean wasn't intentional, as some historians had thought).

So stubbornly proud are some of Pisa's old-timers that they refuse to believe the tower can fall. Legend helps. Some mention an earthquake in 1846 when, according to folklore, the tower touched ground and bounced up again.

Others point to favorable winds. The tower leans into prevailing Mediterranean zephyrs, they say, and is buoyed up.

But the Government Commission for Vigilance for the Stability of the Bell Tower of Pisa is worried. So far they've considered a number of schemes.

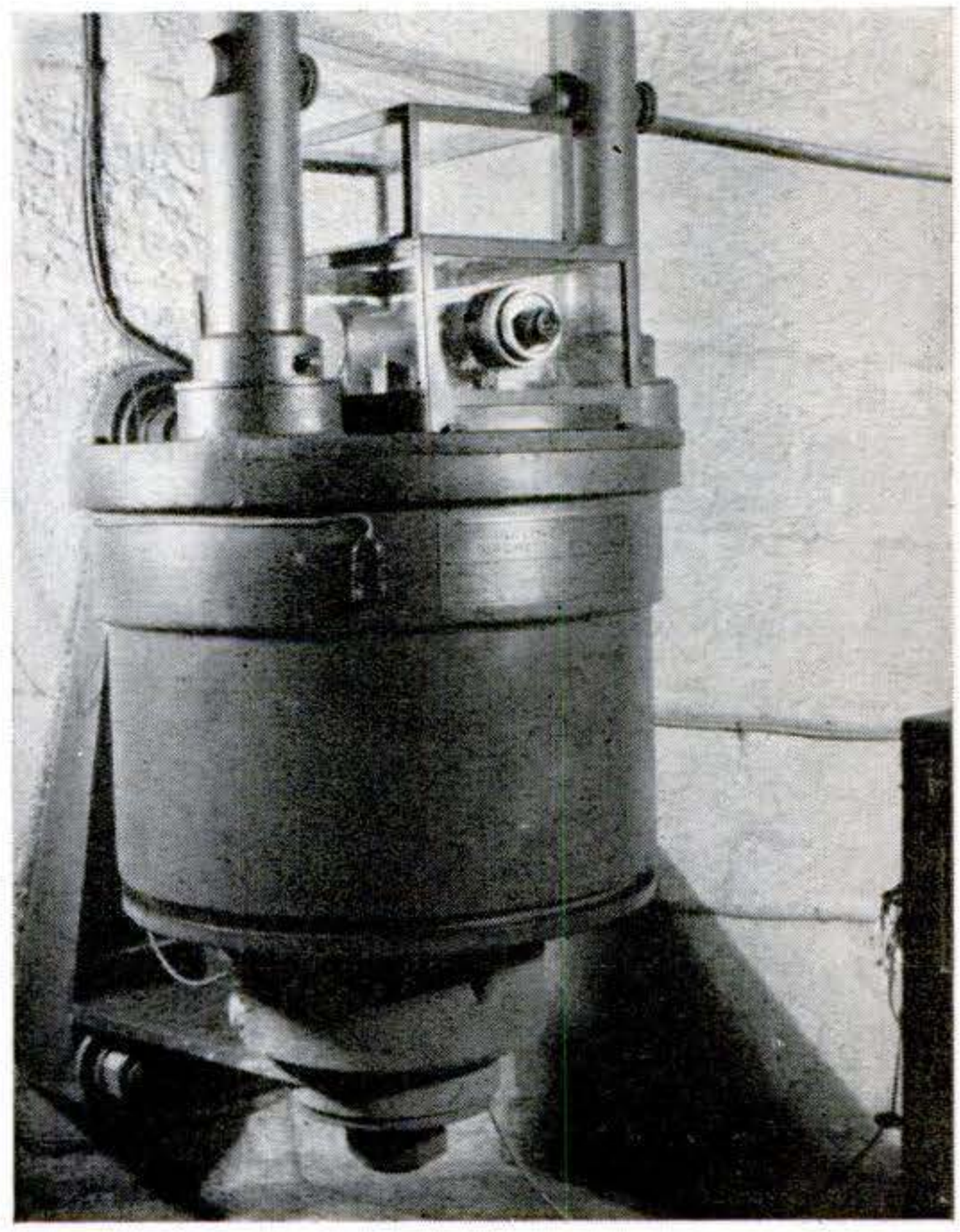
An auxiliary tower. The University of Pisa recommends building a temporary steel tower. This would stand next to the old one and girdle it with iron bands while workmen erected a concrete column through the old tower's center. The steel tower would then be removed.

"Cebertization." A Polish professor, Romuald Cebertowicz, has an electrochemical scheme he calls electro-osmosis. It's a means of petrifying a watery foundation through the action of chemical salts. The salts are spread by electrodes acting as pumps (cathode sucking and anode pressing). The reactions produce chemicals that solidify the ground and attach it to the building foundation. The technique, dubbed "cebertization" by the professor's colleagues, is being tried in Venice where crumbling pile foundations have been threatening many old palaces on the Grand Canal with watery graves.

Jack it up! A British engineer, Fordham Pryke, has suggested jacking up the 14,500-ton tower to a safer lean of 9½ feet, then putting in a new foundation.

While the government weighs the pros and cons of these plans, it has definitely vetoed others. The Texan tourist's, for example. He was all for removing the tower, stone by stone, and setting it up on his nice, solid, dry ranch.

SOARING TO THE TOP of the 179-foot tower are the struts that support an inclinometer. Hardy tourists (Galileo was one) can make the climb up 293 steps of circular staircase.



INCLINOMETER, installed at the base of the tower, periodically records the lean. Seismographs, also installed inside, make 'round-the-clock readings of the tower's every tremor.

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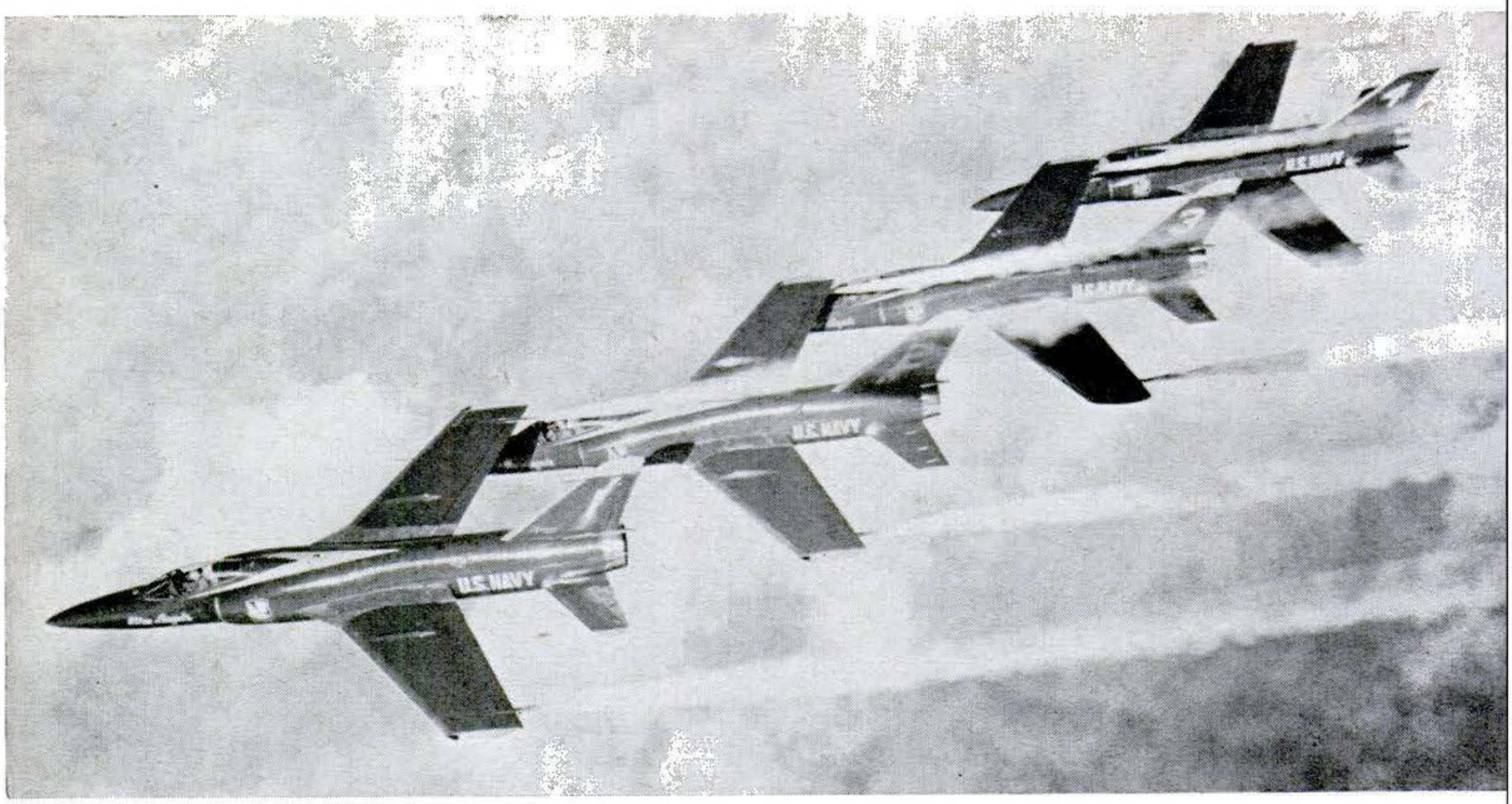


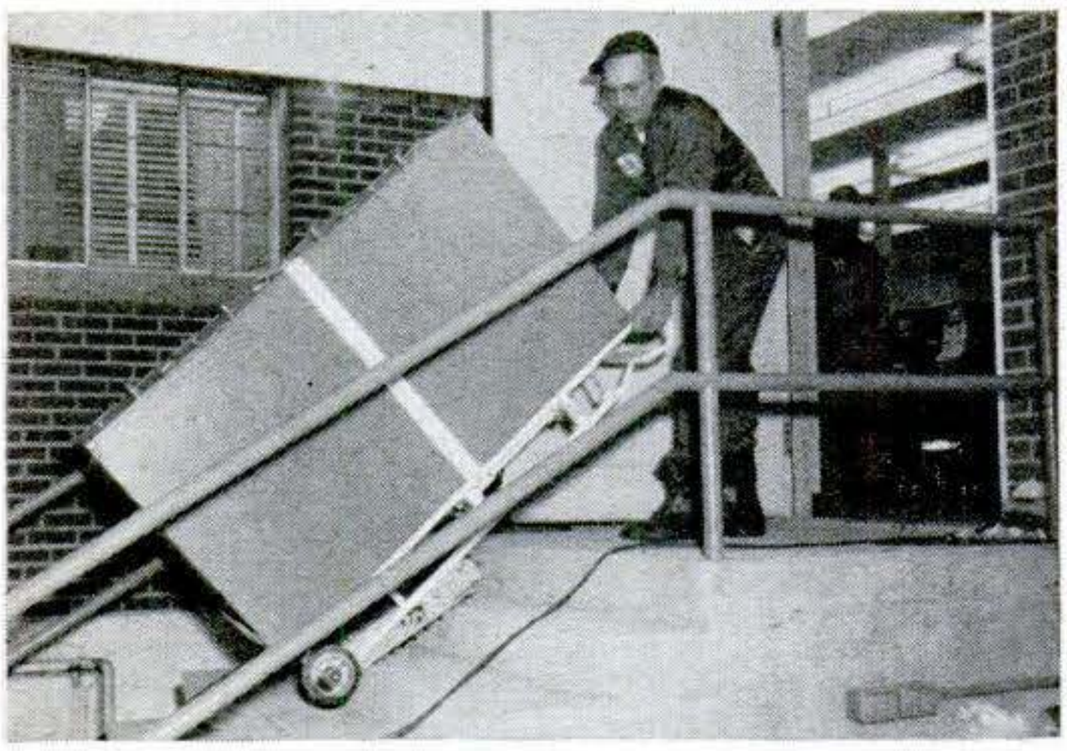
Spectacular view of Blue Angels team in close wing-to-wing formation photographed by Burns.

He shoots Blue Angels upside down

Harry Burns, veteran Grumman flight photographer, has a tricky assignment. He shoots the Navy's supersonic Blue Angels acrobatic flying team in color at speeds up to 600 m.p.h.

Burns usually flies upside down to do the job. His F9F Cougar jet chase plane is the nearest two-seater approach to the supersonic single-place F11F Tigers used by the Blue Angels. It has to be like them, to perform all the maneuvers of the Blue Angels themselves.

His pilot, Lt. Duke Ventimiglia—No. 7 man in the Navy team—is so skillful in flying that he aims Burns' camera directly at wing-to-wing formations as



Powered stair climber

The electric hand truck above can go up or down stairs with loads of 500 pounds. New Design & Development Corp., Lima, Ohio, uses a GE motor and rubber tracks to drive it from a 40-foot cord plugged into a 110-volt outlet. The tracks lock automatically if the power fails.

Homemade truck sleeper

Unlike a standard sleeper rig, this Crosley body doesn't block rear vision from the tractor's cab. W. R. C. Croley, who hauls house trailers cross-country, welded a junk-yard body to the truck's fenders, blanked the windows, installed a sheet-iron floor and a mattress.

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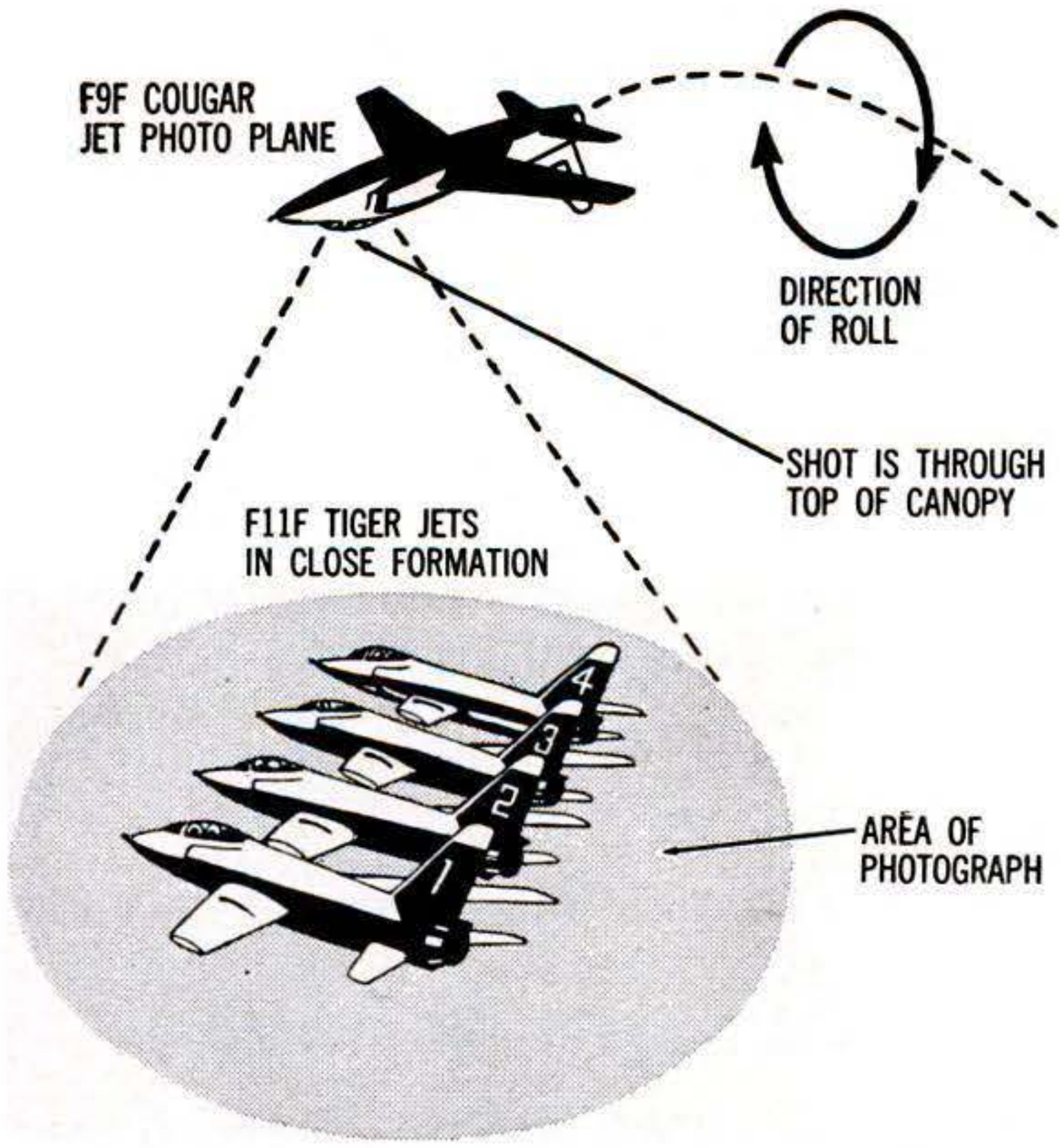


HOW SHOT WAS MADE: Chase plane rolls, puts camera in position for shot through canopy.

CAMERA IS HELD STRAIGHT UP. Canopy is pulled back here to show Burns in place with pilot.

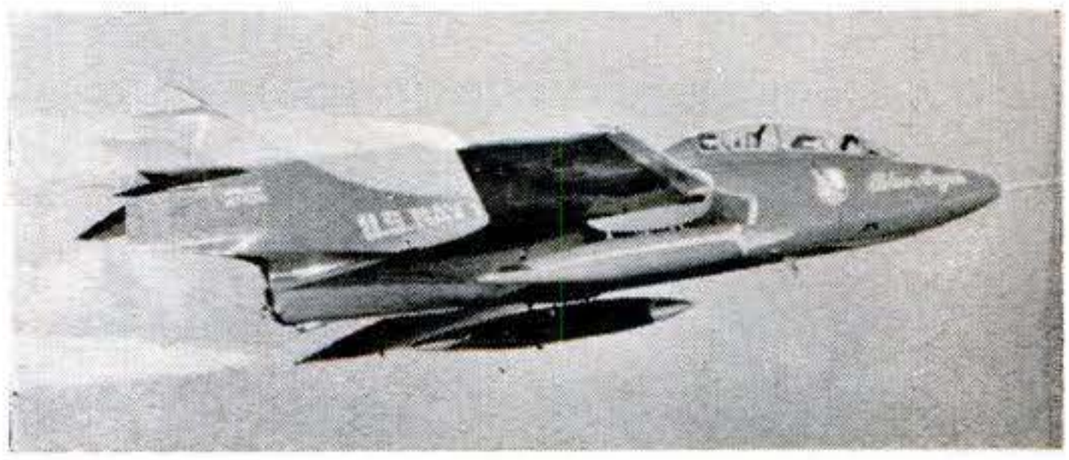


PHOTO PLANE is a two-place F9F Cougar, fast enough to keep up with crack Navy flight team.

they approach their photo rendezvous. Burns' shooting position in the rear cockpit finds him looking straight up through the bubble canopy. He hand-holds his press-type camera to prevent vibration blur and focuses overhead to keep his own plane's wings out of the picture. This requires a slow roll to bring the other planes into his finder. At the exact moment, Burns clicks his shutter at a relatively slow speed. He also uses slow-speed film to get maximum detail and good color value. This is possible because the photo plane and the target move at the same speed throughout the aerial maneuver.

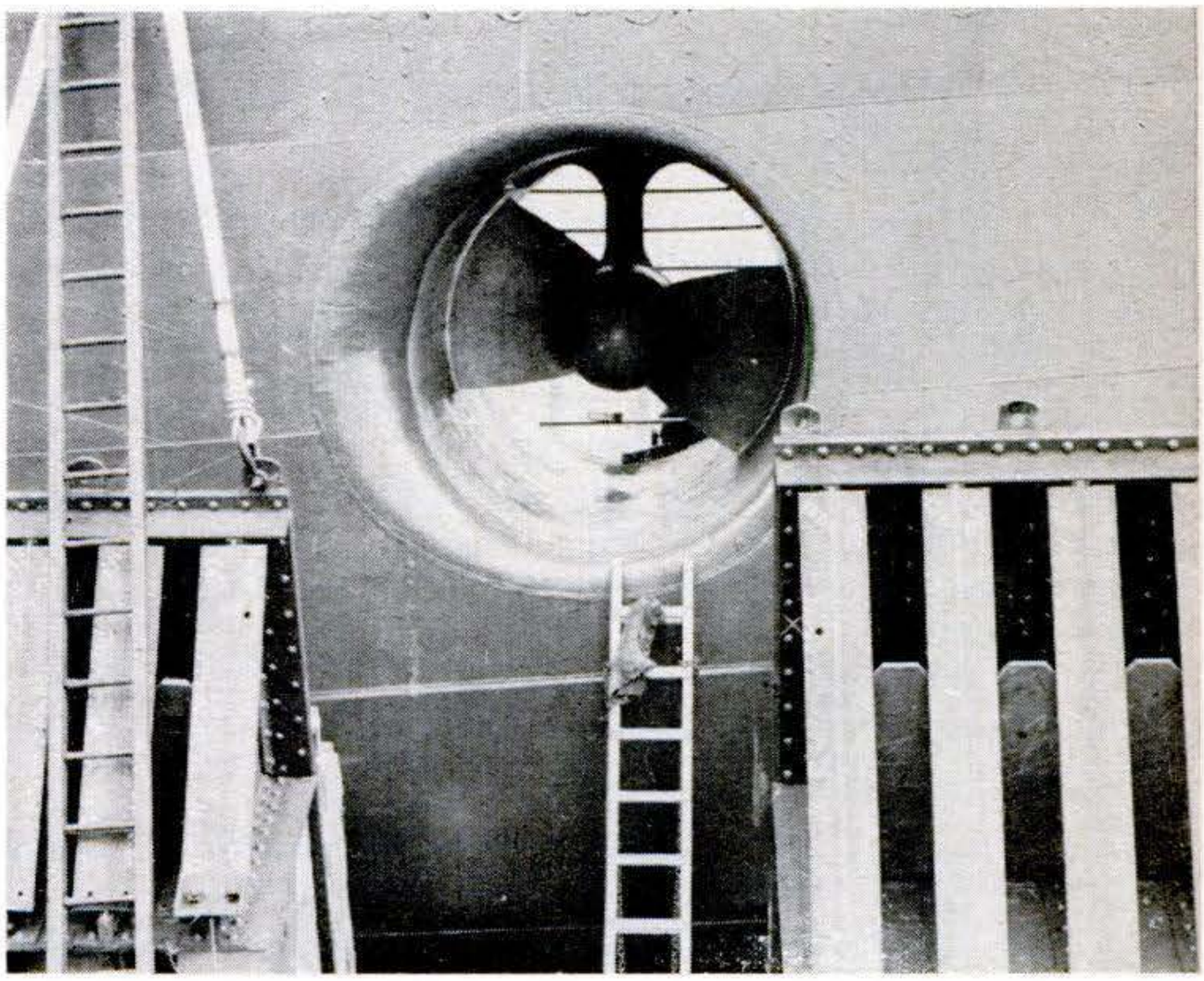
To avoid reflection from his plastic canopy, Burns blacks it out with masking tape, leaving an opening a few inches square through which he trains his lens.

Full speed to the side

A propeller in the bow of Britain's new superliner Canberra will push the 45,000-ton Peninsular and Oriental ship sideways in either direction.

The two-bladed propeller, operated by an 800-hp. electric motor, will provide thrust of anywhere from one to ten tons, will help or replace tugboats, and make it easier to dock the big vessel.

The bow propeller can be withdrawn into the hull when necessary for repairs while at sea.



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The sassy Austin-Healey Sprite

FIVE HUNDRED sprightly miles of winding back roads and high-speed turnpikes convinced me that driving the diminutive Sprite is, above all else, *fun*. The car's forte is handling: The ride is very firm—much like that of the MG and Triumph of yesteryear—and steering is fast and precise.

The entire front of the body lifts, alligator fashion, for full access to the eager little four-banger, a mildly souped BMC A engine that takes 6,000 r.p.m. in stride. The four-speed gearbox shifts crisply, but second gear seems a bit low in relation to third. The dash, though devoid of frills, is fully instrumented, and bucket seats give good support in tight corners. Plenty of leg room, too. Tilting forward the seat backs reveals a small trunk area; the lack of a locking trunk lid, however, can be a problem. The rear of the car, protected only by bumperettes, makes an inviting target for drivers who park by ear.

Though functionalism and easy repair are the keynotes of the body design, the Sprite's squat, nearly curveless contours grew on me quickly.

The penny-pinching Triumph Herald

ECONOMY is a prime attraction in the Triumph stable's latest entry. Though purchase price is somewhat high, maintenance should be very inexpensive. With only 700 miles on its odometer, our test car averaged about 30 m.p.g. in mixed driving; a fully broken-in version should deliver close to 40 m.p.g. on the open road. What's more, no conventional greasing is needed, since most of the mating metal surfaces are nylon- or rubber-lined.

A surprising 25-foot turning circle makes parking a snap, but heavy tire scrubbing necessitates use of low or reverse gear. The driver's seat adjusts up, down, forward, and backward, and tilts—72 positions in all. Interior appointments have a frugal appearance and color combos are gaudy, but floor carpeting is well tailored. The doors don't shut with that satisfying *thunk;* in fact, the one on the driver's side closed properly only after repeated slamming. Head room equals that of most American cars, and oversize windows allow lots of visibility.

The suspension, not quite firm, provides comfort and good roadability.

The eye-catching DKW 750

DON'T buy a Deek unless you like attention. My first day out, a late Chrysler followed me into my driveway and the driver demanded a look at the Lilliputian power plant. The same day, a gas-station attendant almost called the head shrinkers when I poured oil into the gas tank (the two-cycle engine has no oil sump; a pint of oil mixed with every five gallons of gas lubes the seven moving parts nicely).

The 750 has zippy pickup, and top speed and cruising speed both exceed 70 m.p.h. Fuel consumption: a shade under 32 m.p.g. Idle is rough, and a faint, banshee-like whistle (the air intake?) proved disconcerting. A conventional four-speed H, with all forward gears synched, replaces the mixed-up pattern of the earlier DKW 1000, but shift throw remains overly long. Steering and handling are tops. The front-wheel drive is responsible for one unusual effect: Full power through a turn results in tighter cornering. A two-pressure economy accelerator, headlight flasher for signaling, and low-fuel-level warning blinker are desirable extras.

Next month: Special section on the 1961 cars,

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AUSTIN-HEALEY SPRITE

Engine: in-line four cylinder OHV, displacement 57.82 cu. in.; 48 hp. at 5,000 r.p.m.; maximum torque 52 lb. ft. at 3,300 r.p.m.

Performance: top speed 85 m.p.h.; gas consumption 28 m.p.g.

Suspension: front, independent coil springs; rear, quarter elliptic leaf springs.

Dimensions: wheelbase 80 in.; overall length 132.6 in.; width 53 in.; height 49.75 in.; weight 1,428 lb.

Price (P. O. E.): $1,795.

A cool fall day, a twisting lane, and a fine-handling car . . .

TRIUMPH HERALD

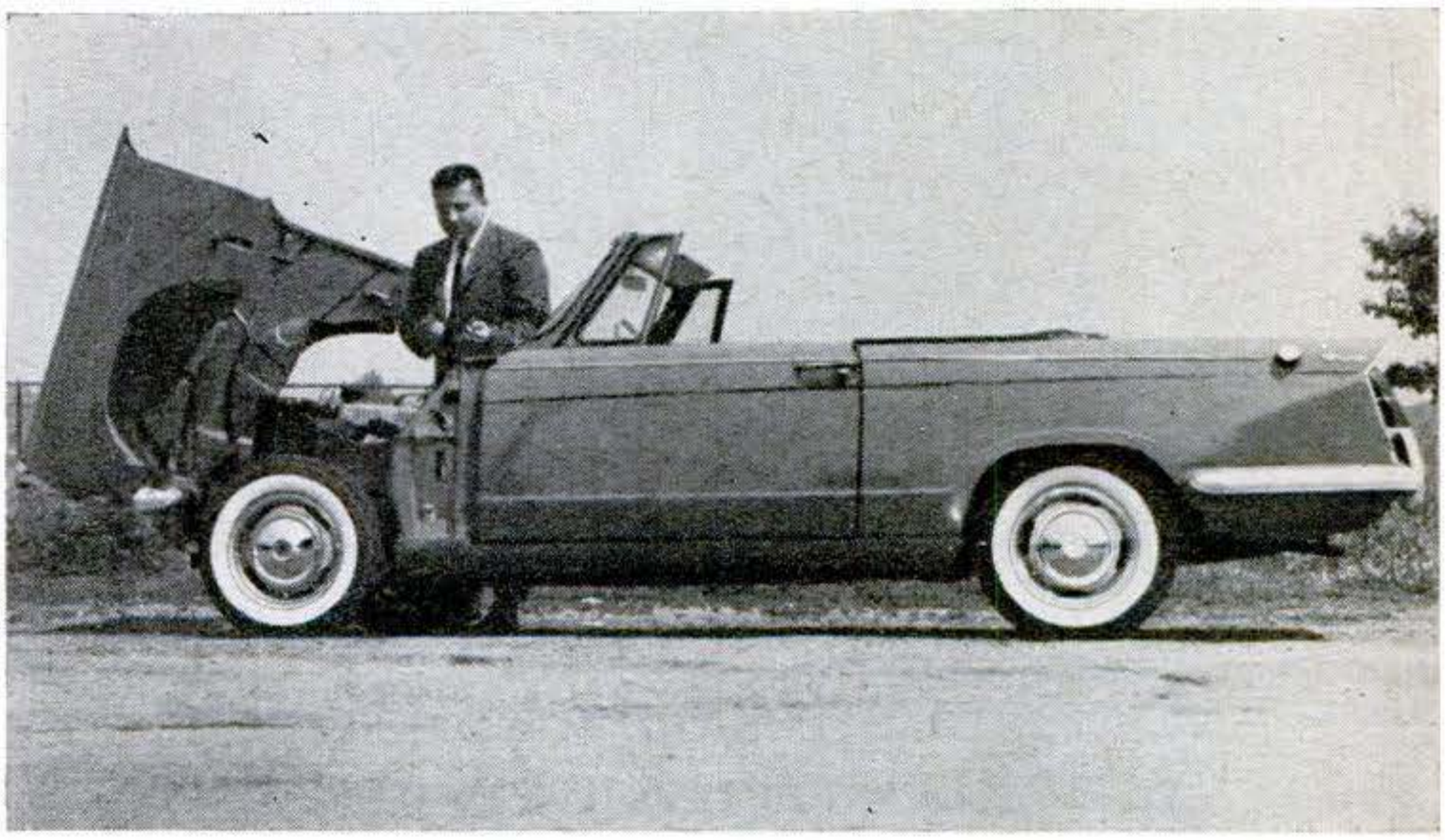
Engine: in-line four-cylinder OHV, displacement 57.82 cu. in.; 50 hp.at 6,000 r.p.m.; maximum torque 50.83 lb. ft. at 4,200 r.p.m.

Performance: top speed 80 m.p.h.; gas consumption 40 m.p.g.

Suspension: four-wheel independent; front, coil springs; rear, swing-type axle with transverse leaf springs and radius rods.

Dimensions: wheelbase 91.5 in.; overall length 153 in.; width 60 in.; height 52.5 in.; weight 1,680 lb.

Price (P.O.E.): $2,229-2,279.



The Herald, like the Sprite, has a highly accessible engine.

DKW 750

Engine: in-line three-cylinder two-cycle; displacement 45 cu. in.; 34 hp. at 4,300 r.p.m.; maximum torque 47 lb.ft. at 2,500 r.p.m.

Performance: top speed 72 m.p.h.; gas consumption 33 m.p.g.

Suspension: front, independent transverse leaf springs; rear, self-stabilizing torsion-arm axle.

Dimensions: wheelbase 85.63 in.; overall length 156.9 in.; width 62 in.; height 55 in.; weight 1,499 lb.

Price (P.O.E.): $1,665-1,709.

Entry is easy. The comfortable cabin boasts careful workmanship.

complete with pictures, specs, and test reports

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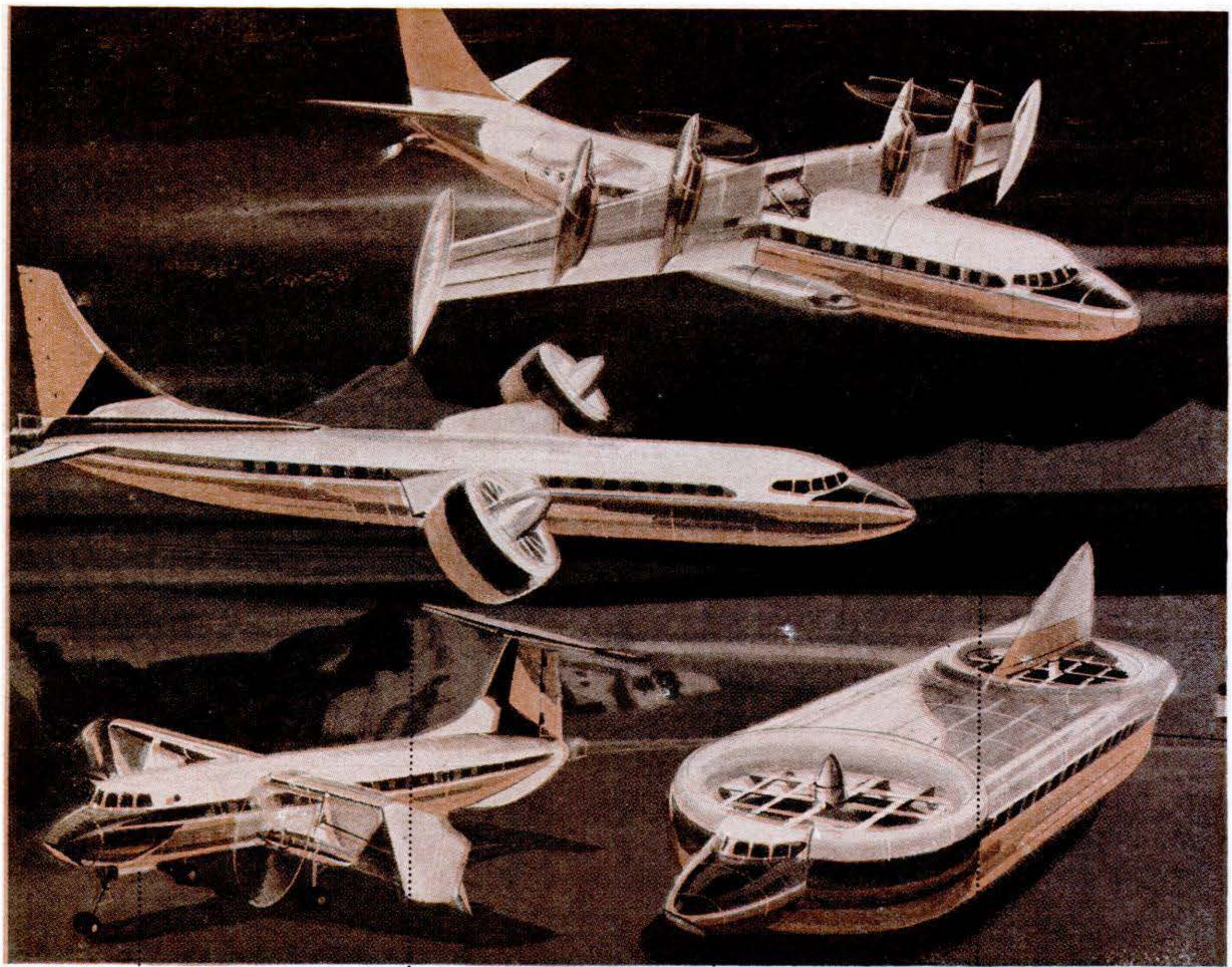
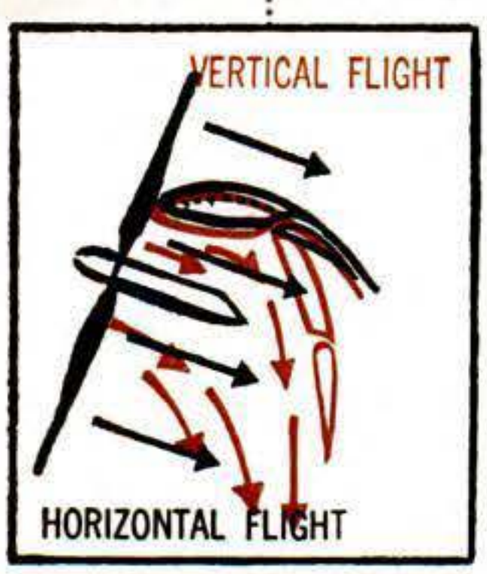
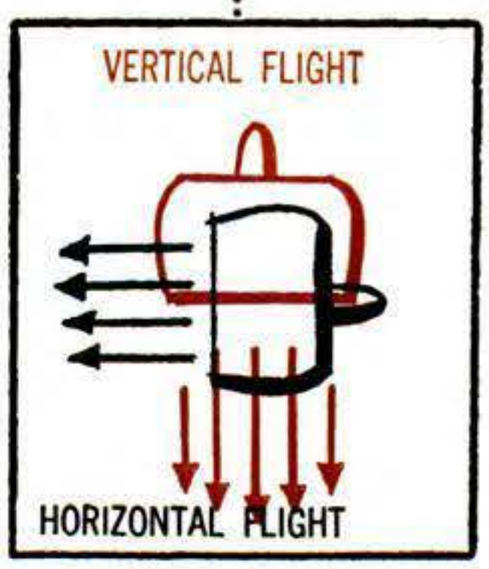
Airliners That Take Off from a Parking Lot

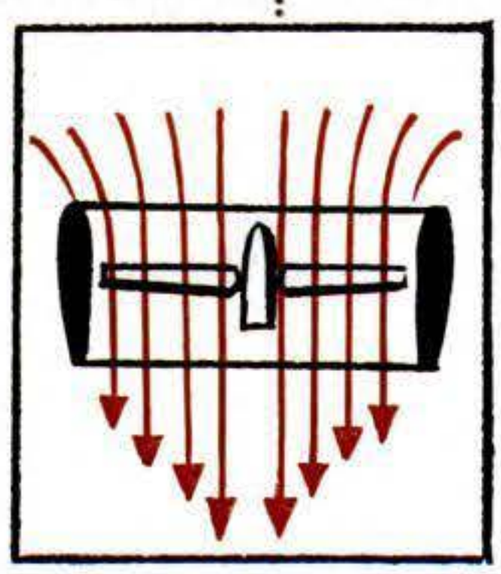




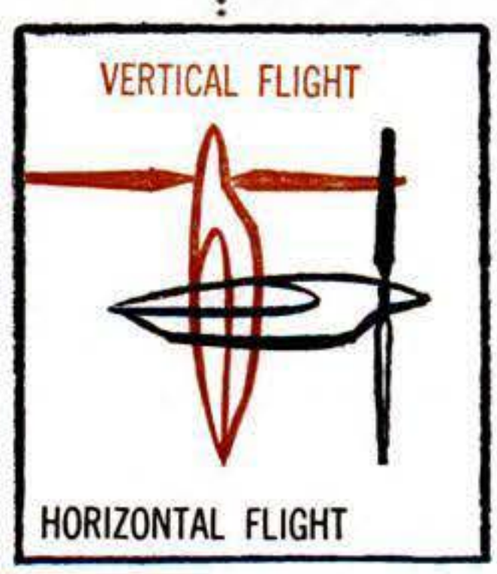
Ryan Vertiplane lowers flaps to bend air flow down (colored arrows), lifting plane straight up



Doak rotates the engines: blowing air down for vertical flight, then blowing air back for level flight



Piasecki Flying Jeep, low-flying, has louvers in fan ducts to guide air flow for maneuvering



Hiller tilts wing and engines together to change from vertical to horizontal flight direction

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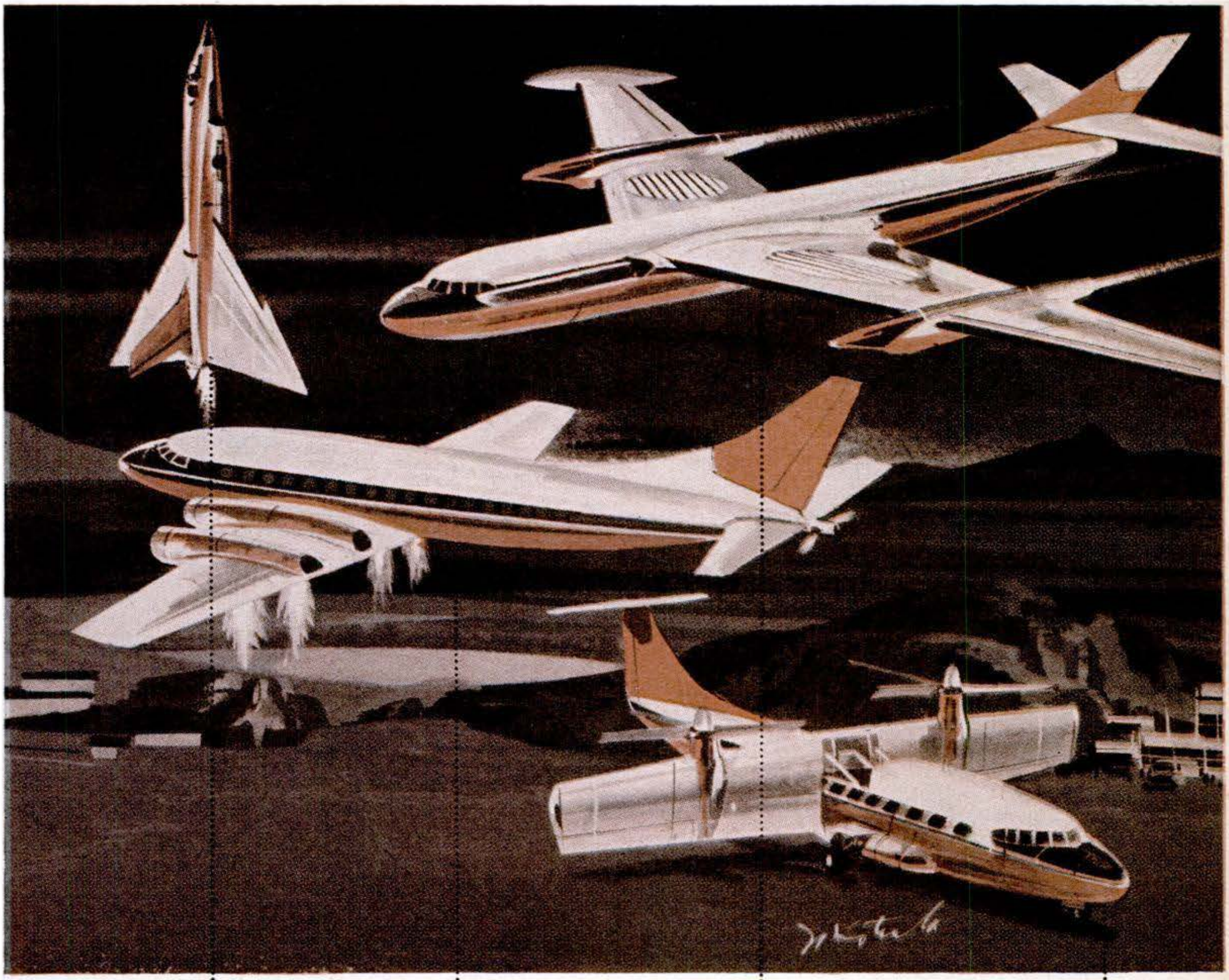
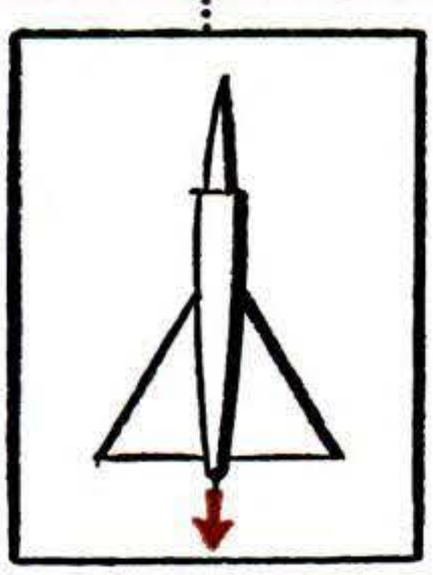
Here come the VTOLs—planes that fly up and down like copters, forward like ordinary craft. They could lead to flying cars

By Wesley S. Griswold

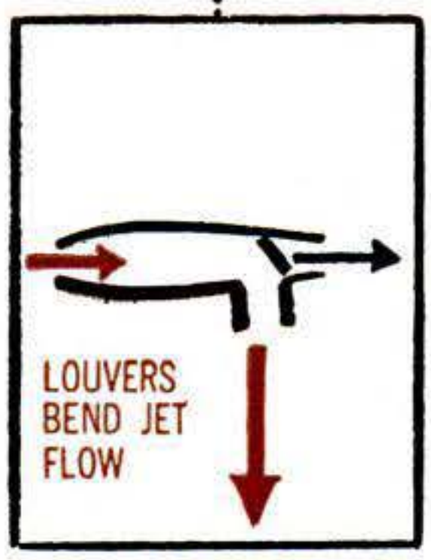
PLANES that behave like beefed-up helicopters seem certain to be flying into your life soon. None of them looks like a copter. Nor do they look quite like any airplane you know.

These curious new planes rise straight up from the ground, then fly normally, and return to earth straight down—gently, of course. They will also hover—stand still in mid-air. They are called VTOLs (pronounced Vee-tols), which stands for Vertical Takeoff and Landing.

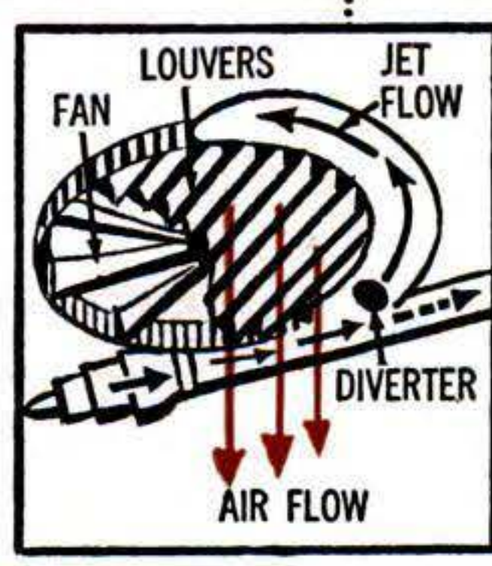


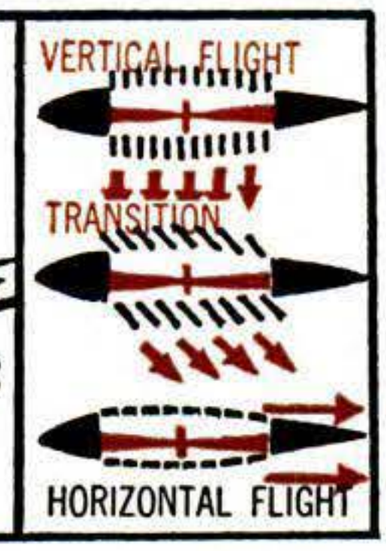


Ryan Vertijet fighter takes off from its tail, noses over for level flight

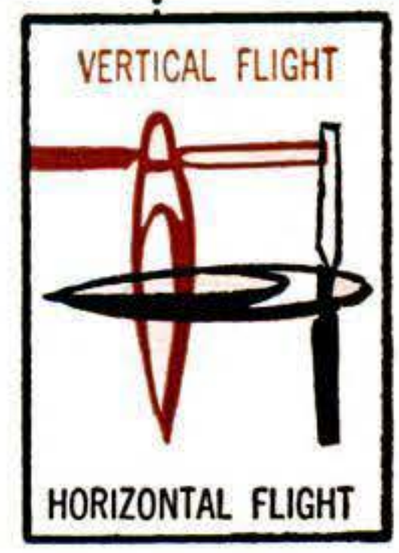


Bell uses jet engine, deflects its thrust with louvers for vertical flight





Ryan-GE Vertifan will fly up on jet-driven fans, forward like ordinary jet plane. It is still in design stage. Small test versions of other VTOLs in drawing have already flown.



Vertol tilts both wing and engines (like Hiller) to change direction

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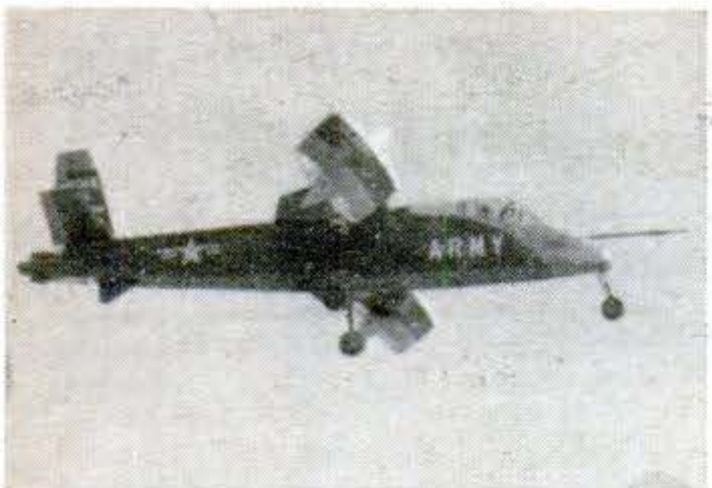

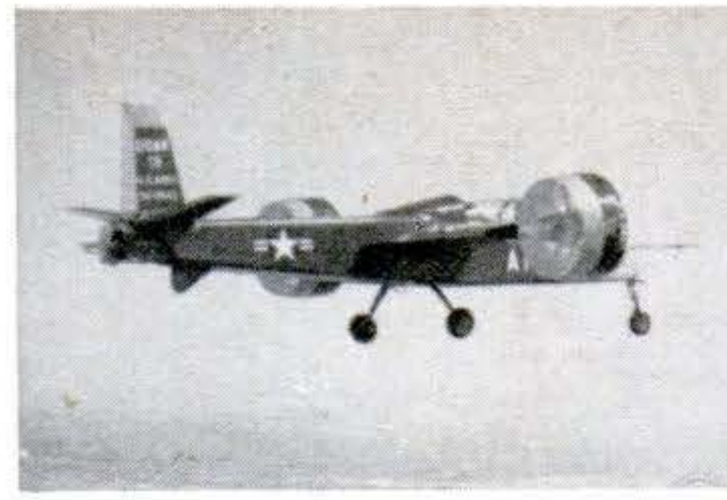

Doak 16 shows that it can be done

Sequence photos start at bottom, with VTOL's ducted fans pointed to pump air down and lift plane up. It rises straight as an elevator until—in mid-air—pilot slowly swivels the fans to direct air flow back. Then it streaks off level, the way old-fashioned airplanes do.

Two pressing necessities mothered this curious flock of aerial inventions.

One need is military. With tactical nuclear warfare a menacing possibility, the armed forces want planes that can rise or squat anywhere. Airfields make much too easy targets.

The other need for VTOLs is commercial. With traffic congesting fiercely in the sky and on the ground, airlines yearn to fly passengers from city center to city center. This can't be done as long as planes are tied to big airports.

Helicopters don't solve these problems. They are far too limited in speed, range, and payload.

The VTOLs now on hand represent a half-dozen engineering answers to the question of how to take off and land a plane vertically. No one type has won out as clearly best.

Biggest bird in the flock is the X-18, built by Hiller Aircraft to prove that a VTOL of transport size is feasible. The X-18 weighs 16½ tons, is 63 feet long, and has a wing span of 48 feet. It got its whopping power plant and 16-foot, 6-bladed propellers from the granddaddy of all VTOLs, the tail-sitting Pogo plane, now outmoded.

The X-18 has two turboprop engines generating 11,700 horsepower. Each spins a pair of enormous propellers, which counter-rotate.

At takeoff, the wing of the X-18 is tilted 90 degrees. Then, with propellers pointed straight up and whirling furiously, the VTOL is expected to climb until the pilot is ready to ease the wing forward and fly the old-fashioned way.

Hiller's VTOL has all the usual flight controls: elevators for pitch, ailerons for roll, rudder for yaw. But in flying straight up or down, there's no prop wash over the tail. The elevators are therefore useless, and their place is taken by a little turbojet engine (3,400-pound thrust) in the tail. The pilot can angle the blast of this engine to keep the X-18 on an even keel. He governs roll by running one engine faster than the other. And he controls yaw by working the ailerons in the down-wash of the propellers. These are admittedly tricky maneuvers until a pilot gets the hang of them.

The Hiller plane is only part way through its flight tests. A smaller tilt-wing craft, however, made by Vertol, has already flown vertically as well as horizontally.

The little Doak 16 is a most promising VTOL, in that it has made more than 20 successful transitional

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flights. Built for the Army by Doak Aircraft, this plane tilts its propellers instead of its wing. The propellers are eight-bladed, four feet long, made of light, tough plastic, and enclosed in rotatable ducts located at the plane's wing tips. They are called ducted fans, and Doak has been experimenting with them for 25 years. Ducts increase propeller effectiveness by a startling amount—as much as 25 percent.

The Doak 16 has a single 825-horsepower turboprop engine driving both fans through shafts. The fans can be rotated 90 degrees, and for takeoff and landing are pointed straight up.

This simple but ingenious VTOL has normal controls and uses them for horizontal flight. When flying vertically or hovering, vanes in the engine tailpipe control pitch and yaw. The pilot governs roll with vanes in the fan ducts. He moves the plane from vertical to normal flight by slowly rotating the fans forward until they are level.

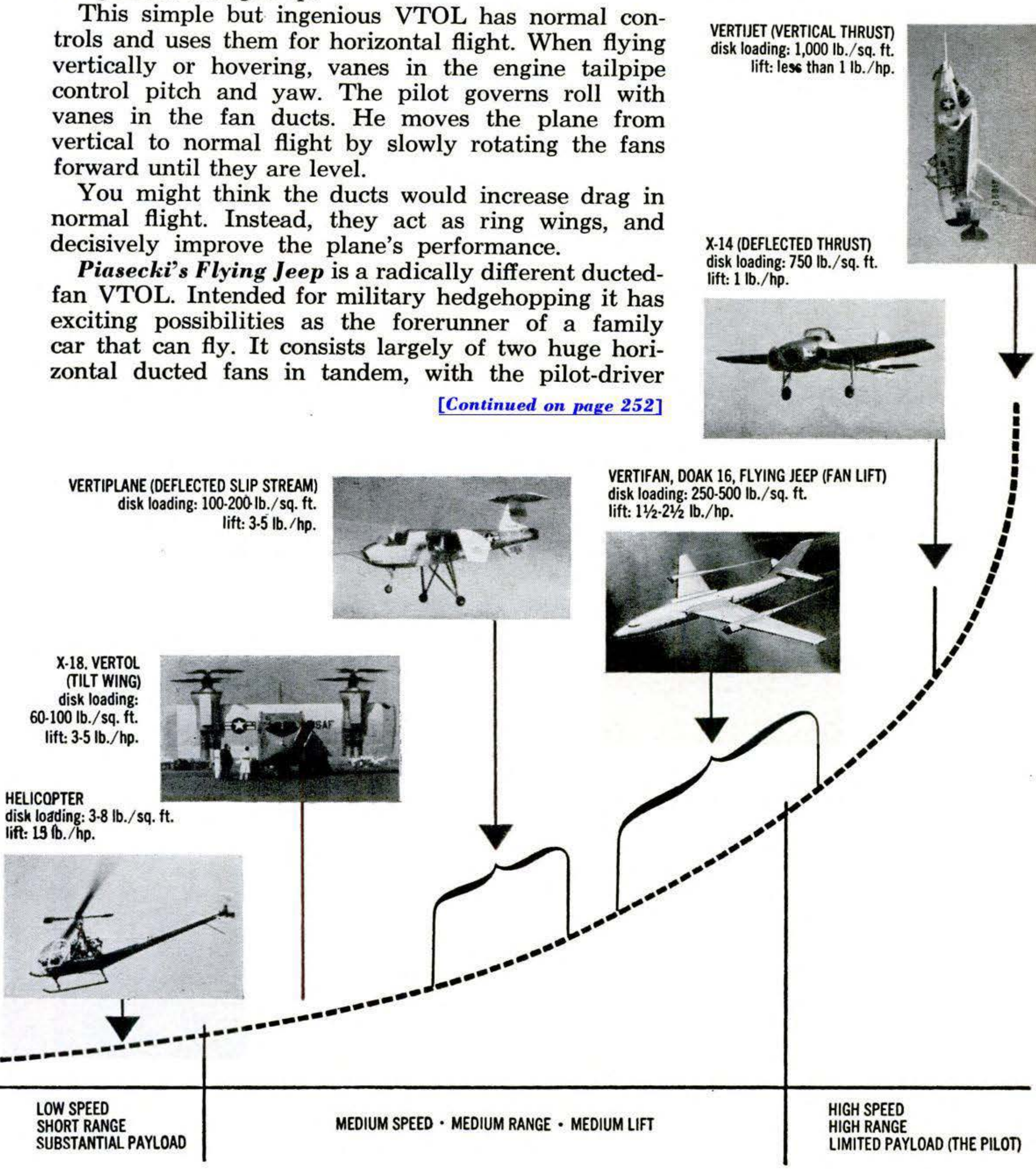
You might think the ducts would increase drag in normal flight. Instead, they act as ring wings, and decisively improve the plane's performance.

Piasecki's Flying Jeep is a radically different ducted-fan VTOL. Intended for military hedgehopping it has exciting possibilities as the forerunner of a family car that can fly. It consists largely of two huge horizontal ducted fans in tandem, with the pilot-driver

[Continued on page 252]

Which VTOL is best depends on the job

Contradicting requirements spawn a variety of types. For efficient lifting, large quantities of air must be moved by props (helicopter). But to go fast, air must be moved very fast (jet). How hard propulsion system must work is indicated by "disk loading"—pressure in the air mass that is moved.



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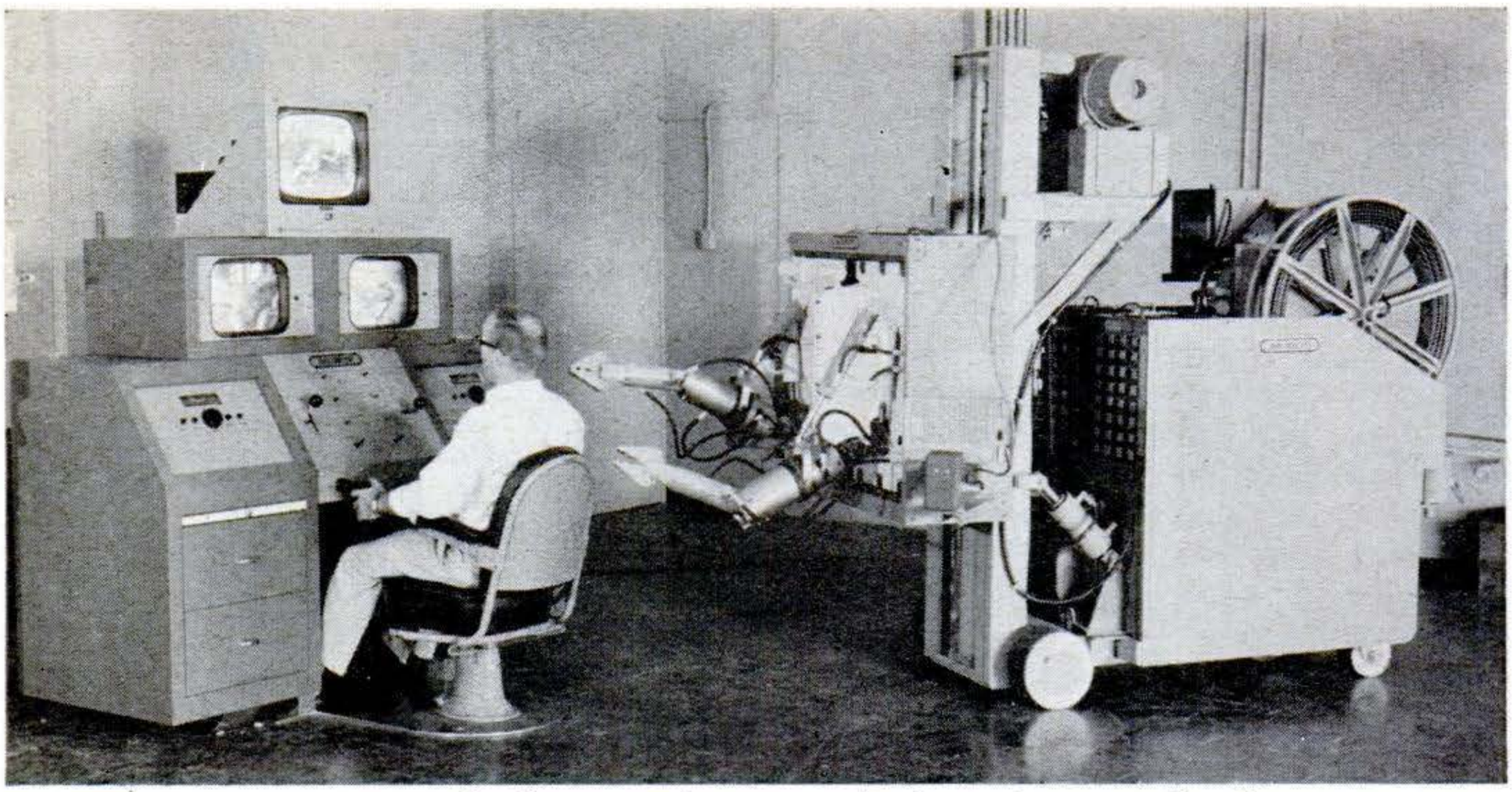
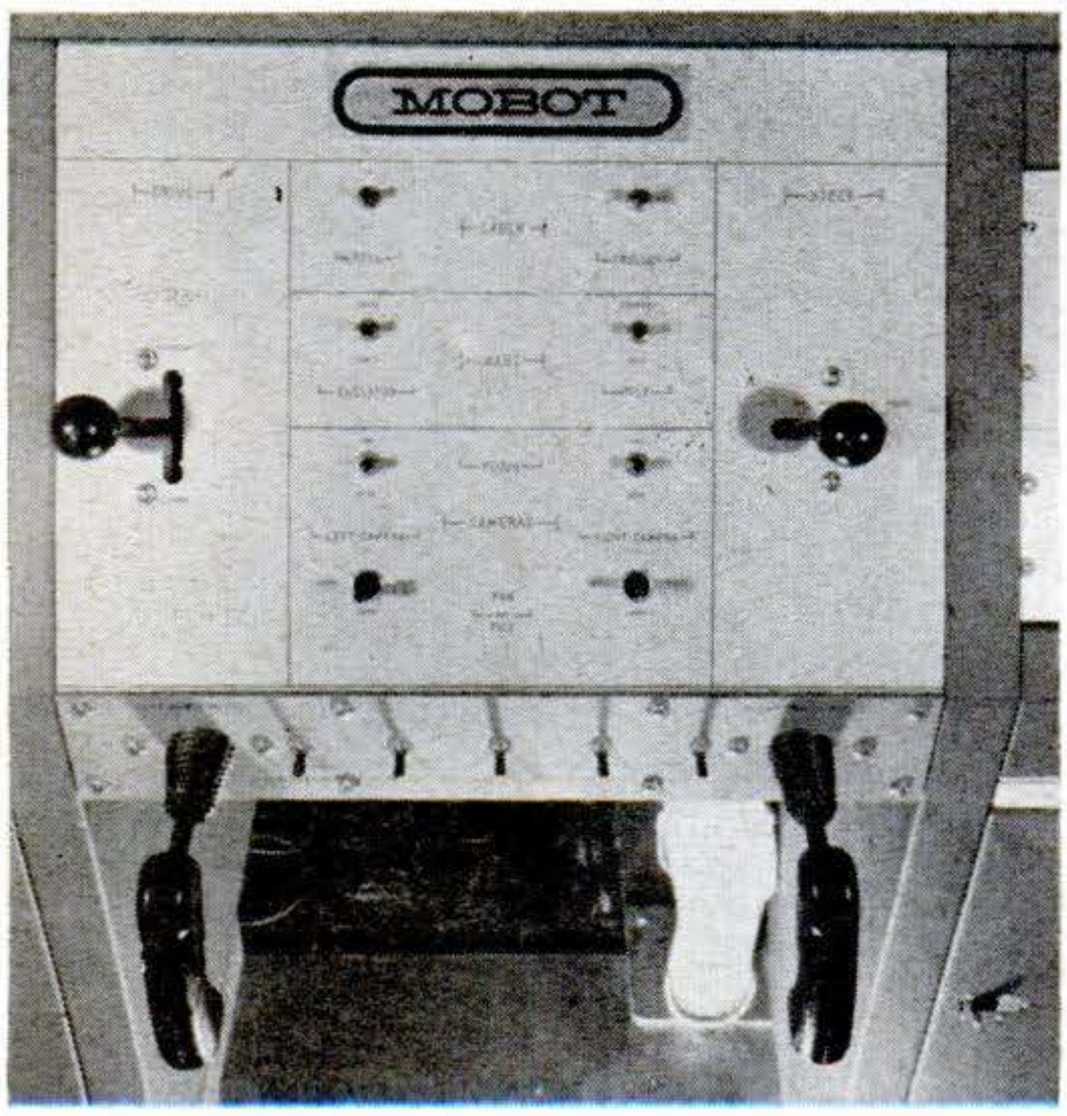


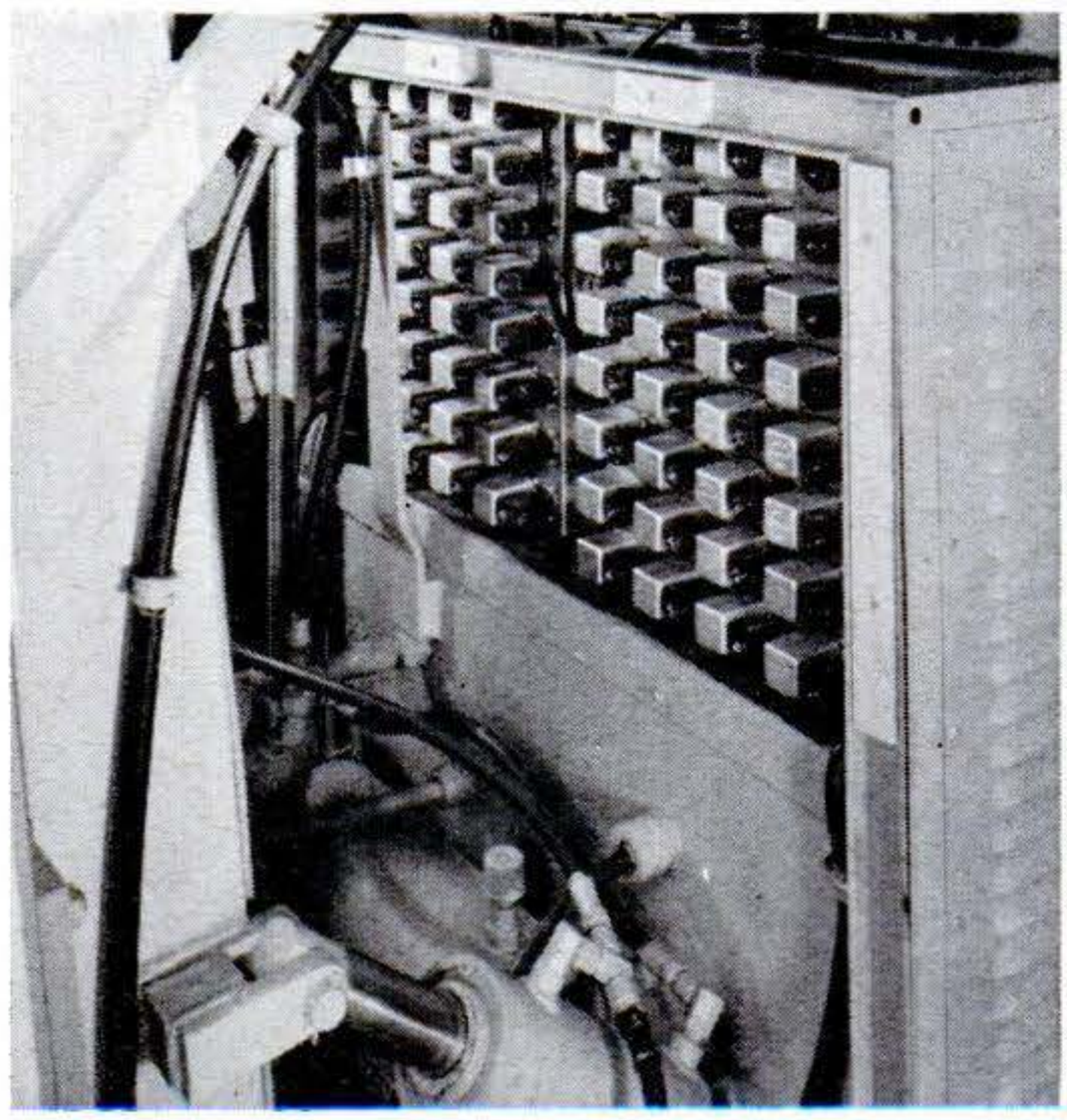
MURDEROUS IMPULSE seems to be driving Mobot to strangle its operator. Never fear, he has it completely under control. Three TV screens show him what Mobot is up to at all times.

Marvelous Mobot Will Do Work Too Hot for Man

WITH electronic nerves, hydraulic muscles, and TV eyes, a robot whose arms are quite capable of playing golf or snuggling a blonde is ready to live far more dangerously than that. Mobot, as the remarkable man-substitute is called, will soon be at work in Albuquerque, N. M., in a radioactive world too "hot" for men to enter. The remote-controlled, mobile robot, built by Hughes Aircraft Co., will fetch, carry, take apart, and put away irradiated test materials in underground rooms next to a nuclear reactor. It will labor for Sandia Corp. and the Atomic Energy Commission at the end of a 200-foot leash of triaxial cable.



MOBOT DRIVES LIKE A CAR, though with two gearshifts. One at left is for forward and reverse movements. One at right steers. Pistol grips control Mobot's arms. Pedal is accelerator.



BATTERY OF SIGNAL MULTIPLEXERS handles all commands from the operator's console to the Mobot. More than 100 different commands can be sent to Mobot through its triaxial cable.

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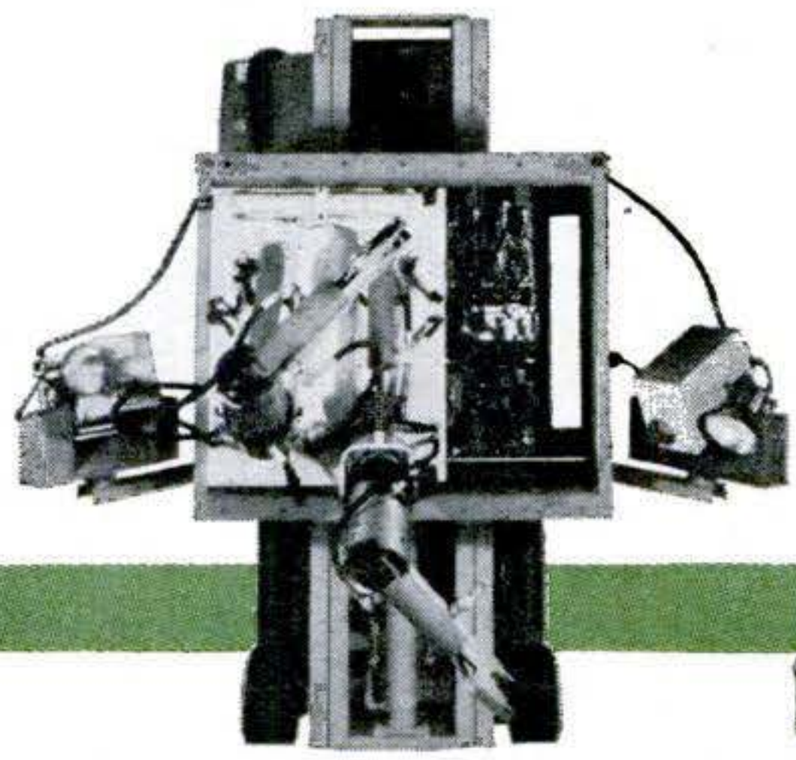
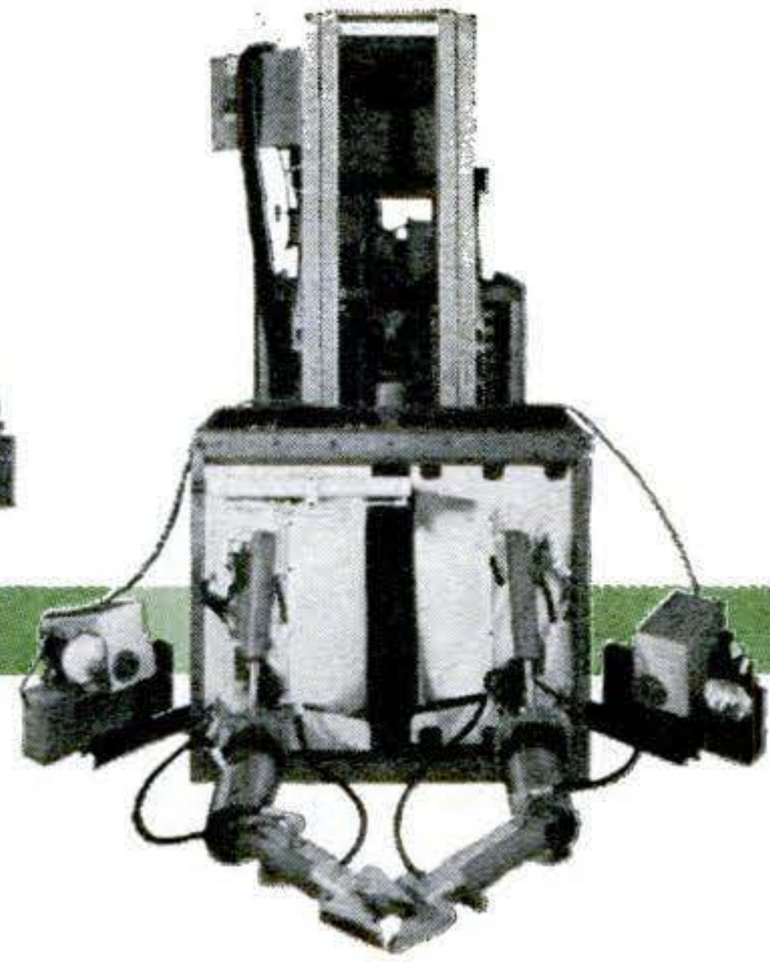
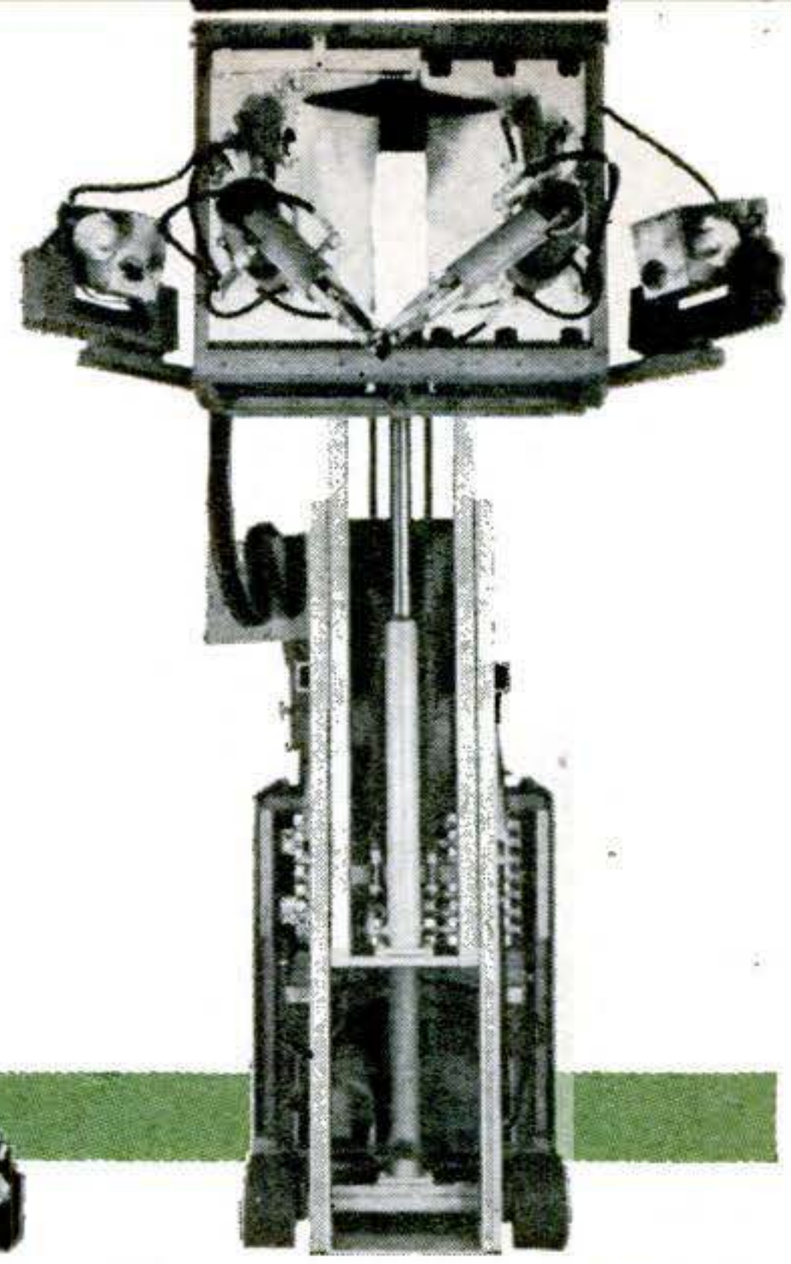
It can stoop, squat, grow 10 feet tall, fetch and carry, handle power tools



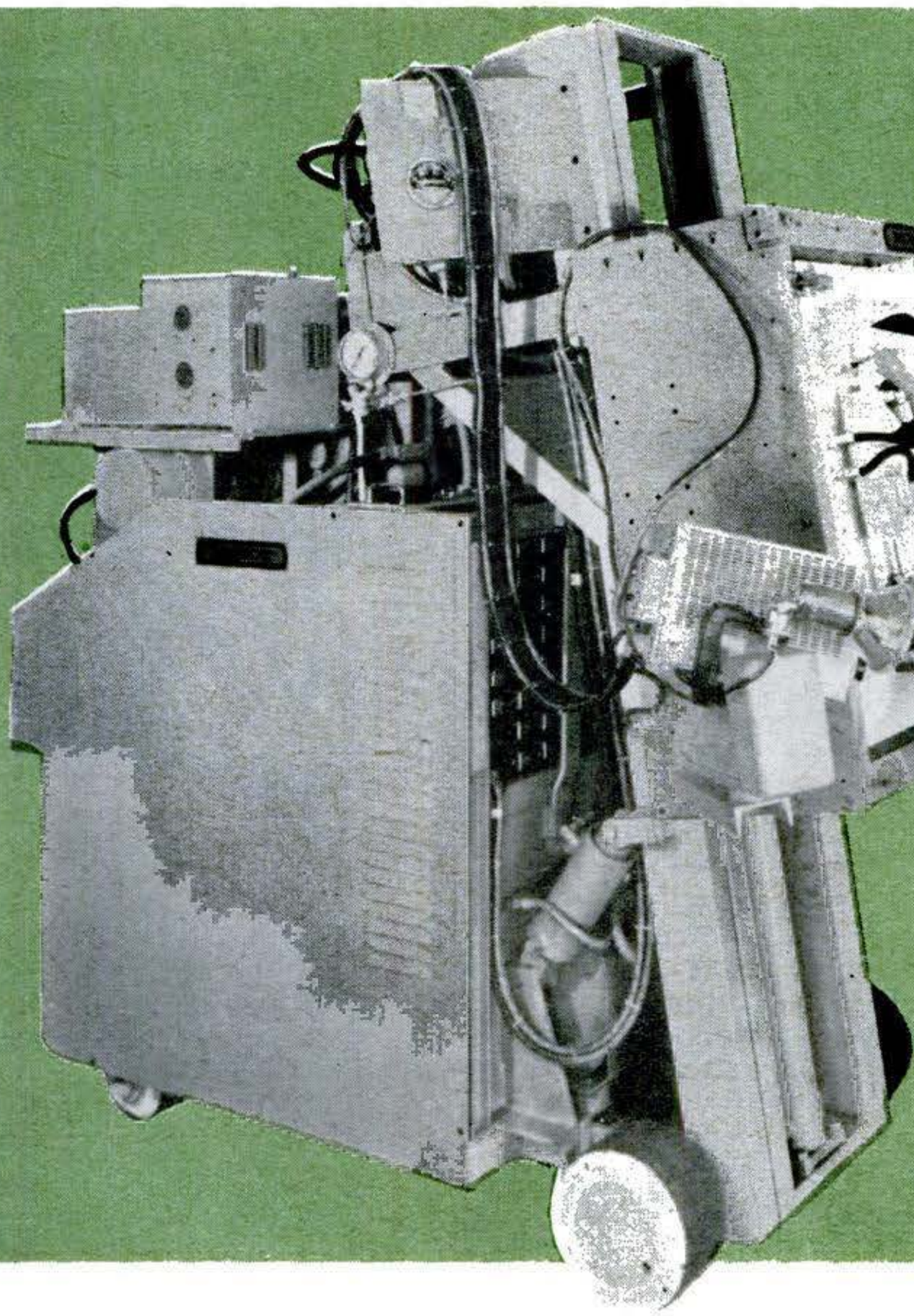
LIKE A BALINESE DANCER, Mobot is fantastically dexterous with arms and hands. "Shoulder" mount can move three feet sideways, and either arm can do anything the other can do.



BASEBALL-CATCHER POSE shows Mobot scrooching as low as it can slide on its mast. One TV camera watches each hand constantly. Jawlike hands can grasp and arms lift 150 pounds.



FOR TOP-SHELF WORK, Mobot's arms can be lifted 10 feet from the floor by means of a hydraulic system separate from the one that controls their gestures. Mobot weighs 4,500 pounds.



HAND-DUSTING GESTURE signals that Mobot is calling it a day. Those jawlike hands can operate power tools when the tools have special grips. Vehicle has its own battery and DC motor.

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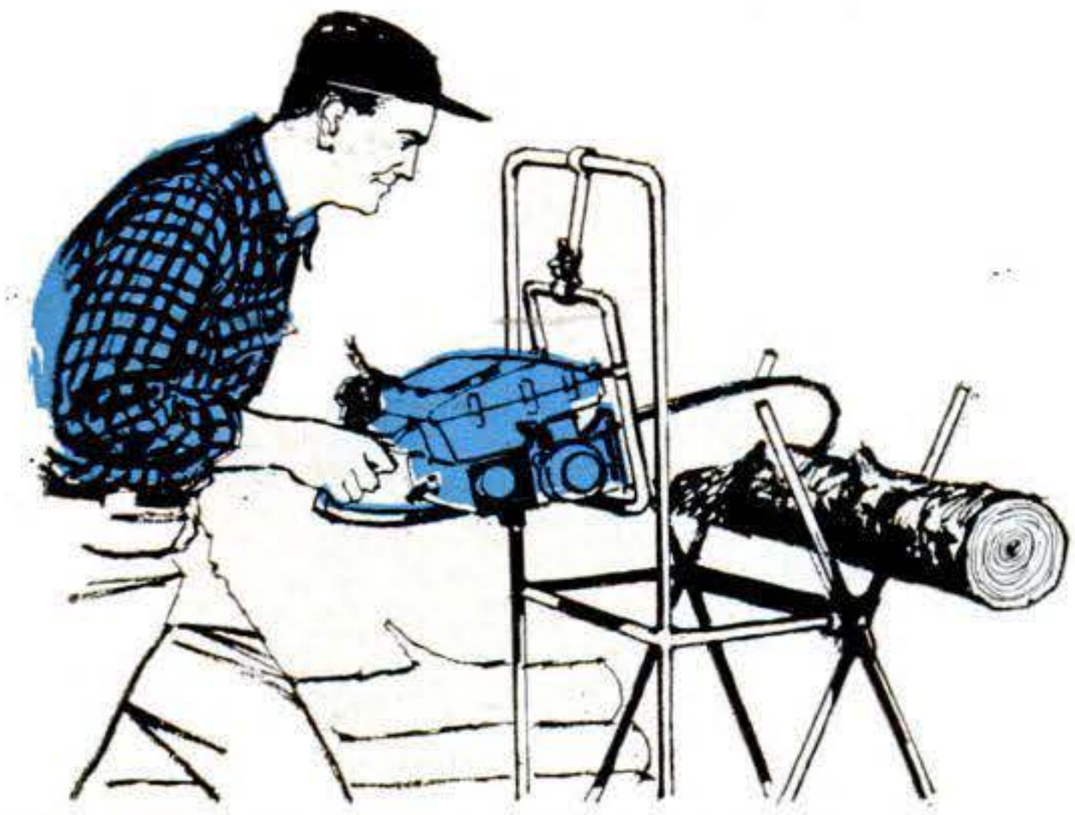
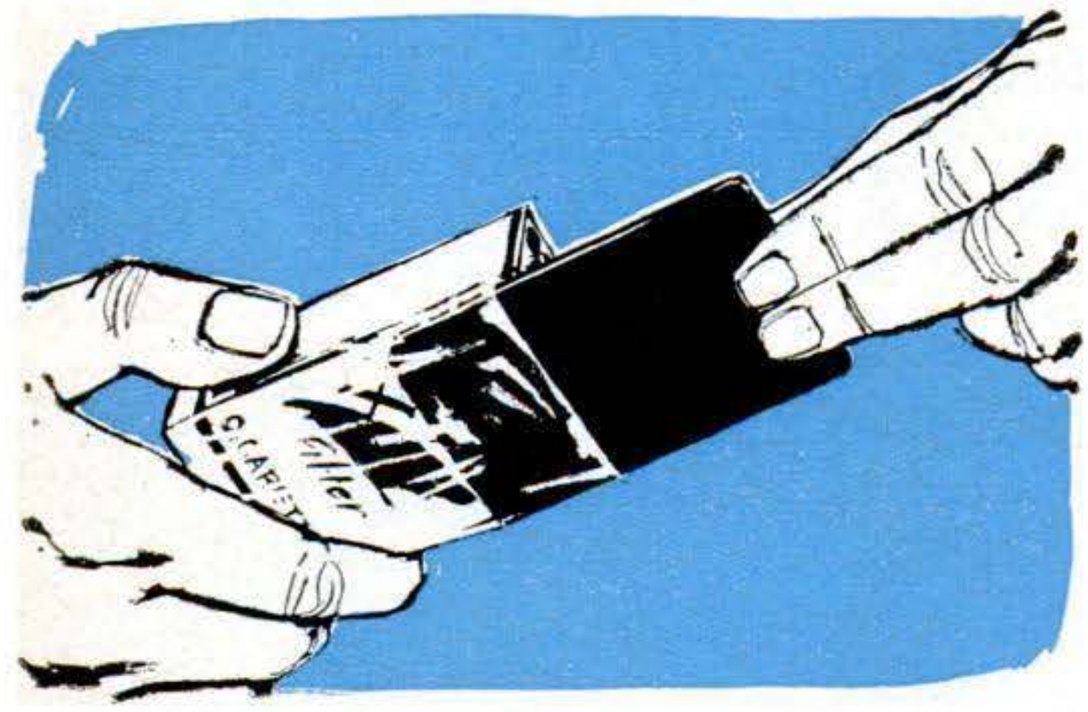
"I'd like to see them make..."



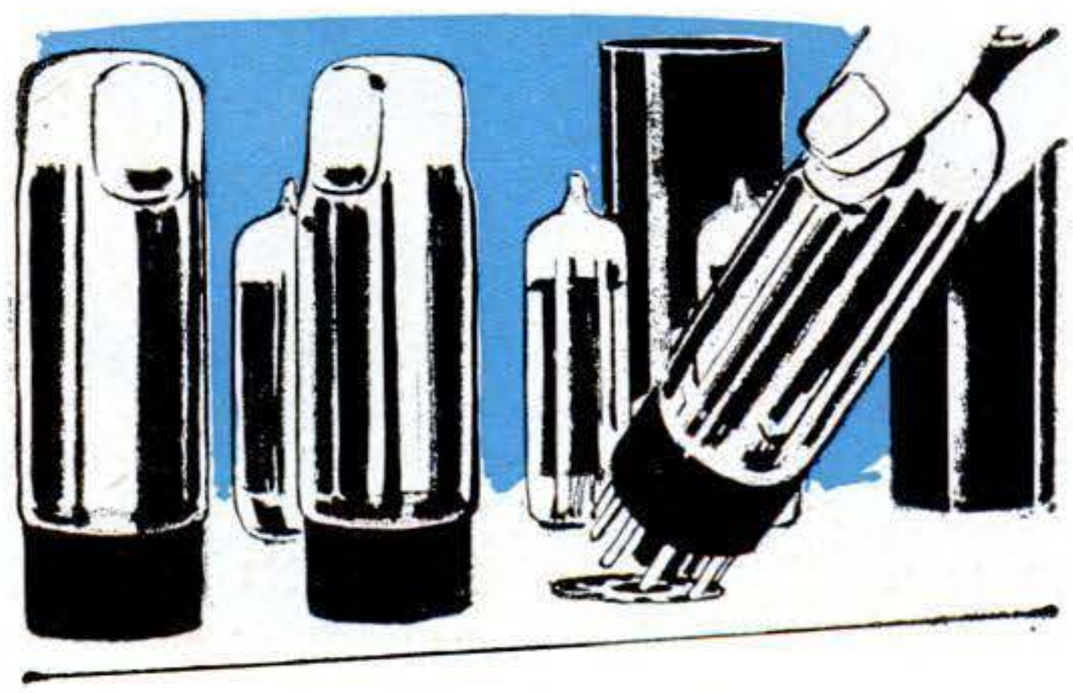
AN ALUMINUM SAWBUCK that would support a chain saw as well as cradle the log. A sling arrangement would allow the saw to swing as necessary.—*David Hogg, Westford, Mass.*



A THIN, MAGNETIZED PLATE to slip under the cellophane wrap on cigarettes so you could toss the pack on top of your car's dash and keep it anchored.—*E. L. Enochs, Glendale, Calif.*

VARICOLORED FISHLINE with a color change every so many feet. Then it would be simple to tell approximately how much line had been reeled out.—*Peggy Kaluz, Marquette, Mich.*

A CURRYCOMB ATTACHMENT for the vacuum cleaner. A few passes with this and you could rid a household pet of loose hair or burrs.—*Mrs. Winifred Maker, Douglas City, Calif.*



EASY-TO-PULL TUBES for radios and TV sets. A thumbprint impression on each side of the glass envelope near the top would give you a better grip.—*C. E. Harris, Odessa, Tex.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

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EIGHT-WHEEL digger-scraper, being used to build new U. S. super-highway network, is one of the most brawny LeTourneau machines. It scoops up and totes away 55 tons.

LeTourneau: The Man Who Moves the Earth

To this world-famous designer, no job is too big—it's only that machines are too small

By Devon Francis

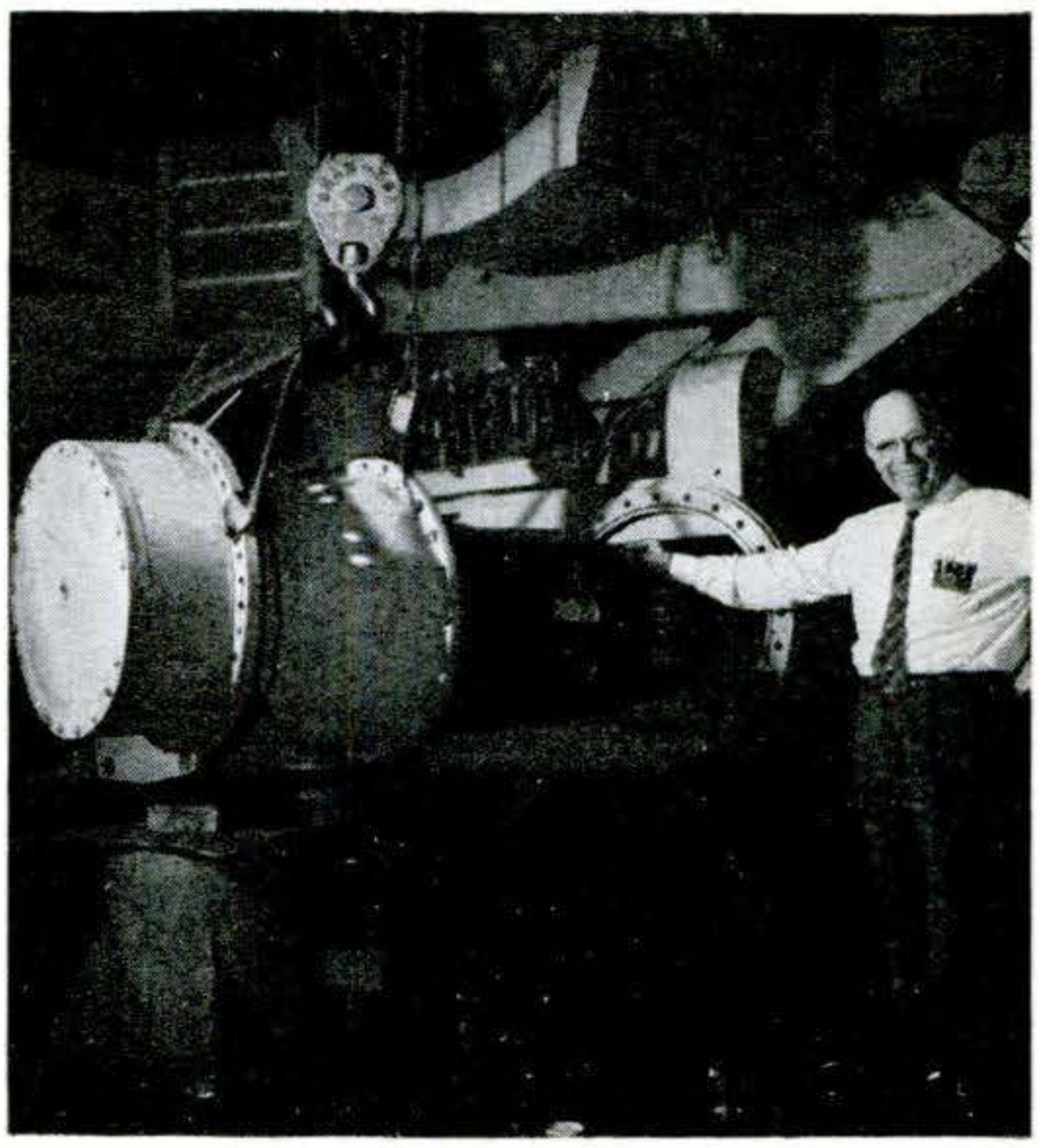
NEAR Longview, Tex., the other day an automobile driver came smack-dab against an irrigation ditch in his path. The ditch was three feet across and six deep.

"Think I'll jump the car over it," said the driver.

"If you do," said a companion beside him, "you'll do it alone." He got out.

The man at the wheel backed off, threw the car in gear, and charged at the ditch. He expressed no surprise when he made it.

The man was Robert Gilmour LeTourneau. Everybody knows the name. It's painted prominently on the world's



HUGE DC MOTORS are used in each wheel for precise torque, speed. Lighter, more compact AC motors power the steering and dump gates.

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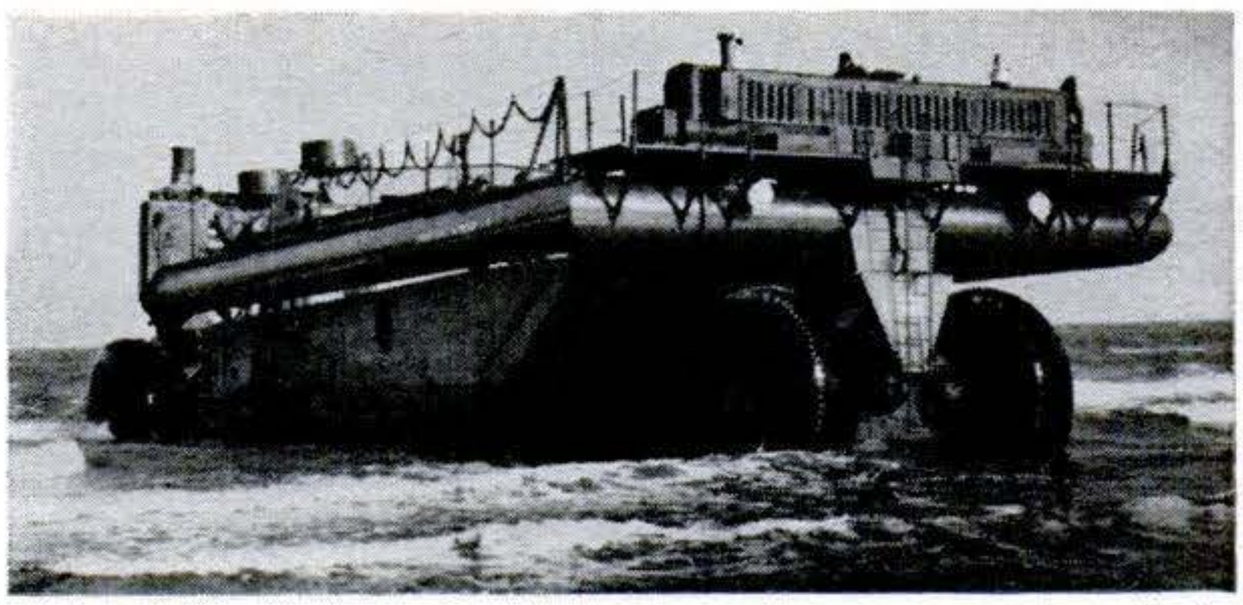
LeTourneau's machines are colossal



BIG-TIRED WHEELS, with as little as five pounds of pressure, operate in surf to rescue Navy vessels in trouble. The vehicle is a landing-craft retriever.

HUGE LIFT TRUCK with elephant-tusk forks handles logs of any size. LeTourneau's first invention was somewhat smaller—an exhaust cutout for automobiles.

biggest wheeled vehicles, in use practically everywhere. LeTourneau's earth-moving machinery is a common sight in Fairbanks and Melbourne, in San Francisco and New Delhi, in Oslo and Johannesburg.

Seven out of every ten bulldozers used by U. S. construction battalions during World War II in Europe, Asia, and the South Pacific bore the name LeTourneau.

Only the biggest. LeTourneau mechanical diggers are at work on the new American network of superhighways, moving more than 50 tons of earth at one gulp. LeTourneau tree-crushers are carving farms from jungle land in Liberia and Peru. Another kind of LeTourneau machine—jumbo-size, naturally—stands spread-legged in Texas tideland salt water and the Persian Gulf to serve as half-acre platforms for oil derricks. A modification of this machine is to be used to build a bridge across the strait connecting the vast lake of Maracaibo and the Gulf of Venezuela.

Bob LeTourneau probably has done more singlehandedly to alter the looks of the world's topography with mechanical tools than anyone else in history.

Jumping the car over the ditch was typical of him. It was 4½ miles to the nearest bridge. He was in a hurry. He adopted what was—to him—the simplest and quickest solution to the problem.

All of LeTourneau's machines reflect this elementary approach to design. They are gigantic, tremendous, colossal, and awesome, but they are also simple. When one of his machines for toppling big trees kept losing its footing at the task, he said, "Attach a spade to it." That's the same thing used to anchor an artillery piece against recoil. It worked.

LeTourneau likes to say of himself, "I'm only a mechanic." That's bosh. His associates say he's a mechanic's mechanic. That's more like it. LeTourneau is a natural, self-taught mechanical and electrical engineer, touched with genius.

He quit school at 14. Today, at 71, he is more than a towering personality in his field of manufacture. He is also one of the last of the industrial titans, a special breed of men who fought their way to riches by sheer shrewdness, stamina, and imagination.

Henry Kaiser, an old-time friend, understands LeTourneau because he is out of the same mold. Henry Ford the elder would have, too.

Machine philosophy. One credo on machine design has stuck with LeTourneau ever since he stumbled into the manufacturing business as a young man. He quotes it in his just-published autobiography, *Mover of Men and Mountains*

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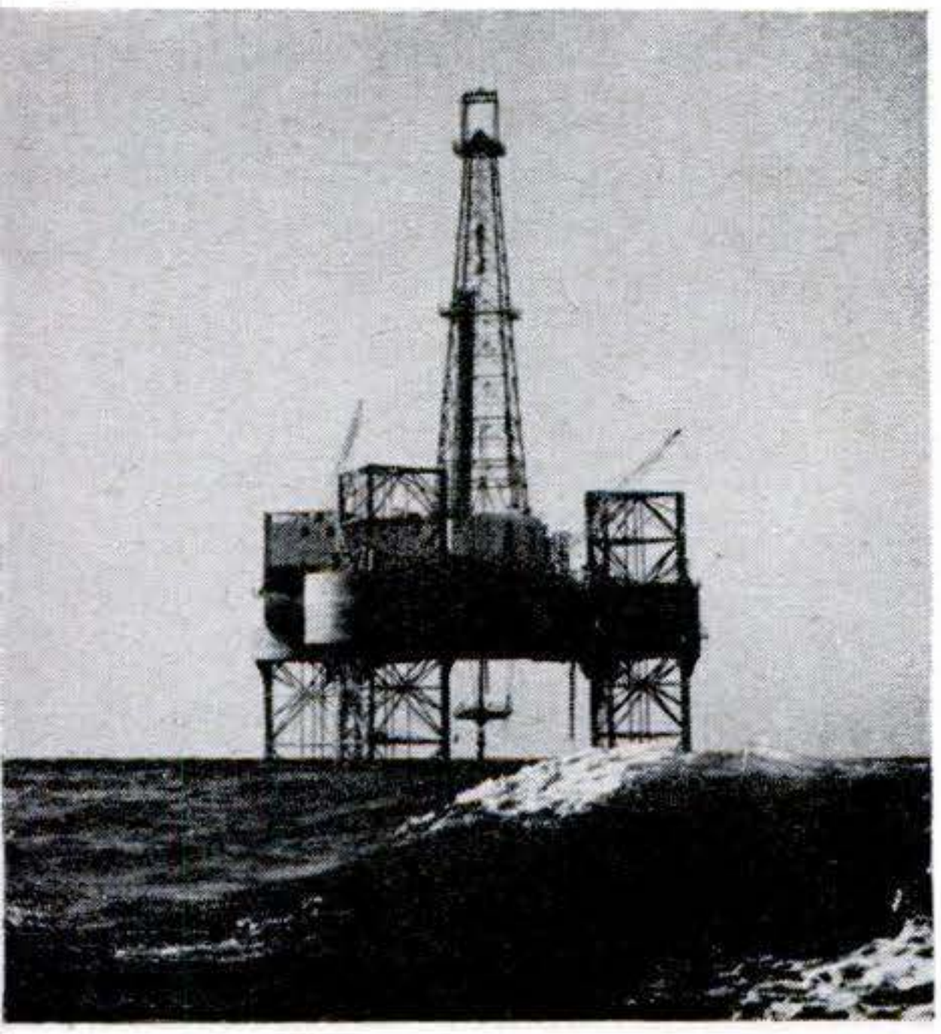
and awesome, but they all reflect his simplicity in design



OIL-DRILLING platform (above) floats to site, raises itself on steel legs when given a hefty boost by three electric motors.

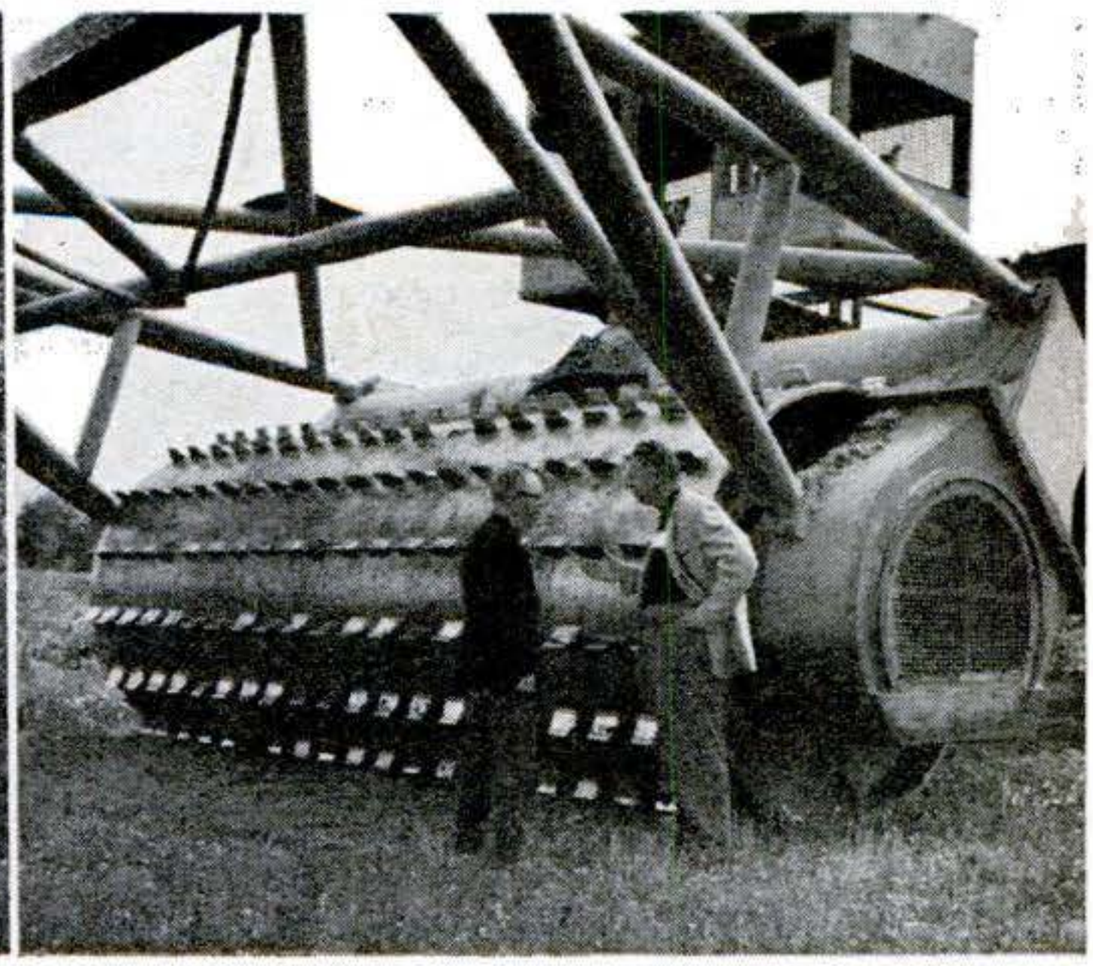
MISSILRY MACHINES were, for a time, a company product. This one carries the Army's Corporal. LeTourneau never uses steel cables to transfer power. He says gears do a better job.

(Prentice-Hall): "The fact is, there are no big jobs; only small machines. The Panama Canal and the Suez were big because they were measured with teams of mules and a hand shovel."

He proves it. His jungle crusher will knock down 1,300 tall trees, each a foot in diameter, every hour. The machine was built for it. It's 76 feet long, 25 feet wide, 19 feet tall, and weighs 150 tons. It can fell trees five feet in diameter, too. They just take a little longer.

Known by his thousand-odd employees at his Longview and Vicksburg, Miss., manufacturing plants as "The Old Man," and to his intimates as "Pop," LeTourneau is no easy man to work for.

He is out of bed at six o'clock, at his desk by seven. Devoted to his job, he expects equal devotion from every man on the payroll. He drives himself all day. Several nights a week he returns to his desk for a two-hour stint before bedtime. A covey of his engineers has to be on hand. They divide up this labor among them.



TREE CRUSHER, weighing 150 tons, is one of latest LeTourneau inventions. Cylindrical front "wheel," which steers, contains 360 steel cleats, each individually welded to the roller.

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MAMMOTH GEARS for LeTourneau machines are always cut (by acetylene torch) from forgings, never cast. Now changing from diesels to gas turbines, company is eyeing atomic power.

"Pop is the only man I know," says his personal assistant, "who kills time by working it to death."

When he isn't at his desk or drafting board at night, he's at a church service. Deeply religious and a lay preacher, each year he flies 100,000 miles—half of his total air travel—to appear at church gatherings. His jungle-clearing projects, called missionary-industrial enterprises, are nonprofit.

Rolling his own. LeTourneau's manufacturing empire, though modest in size compared with many corporate giants, is complete. He makes everything that goes into his machines except the diesel engines that power them and the tremendous tires that they roll on. He even makes the molds for the tires. He had to. Akron's rubber companies weren't equipped to do it. He makes his own steel and shapes it in his own rolling mill.

He welds everything, for extra strength. POPULAR SCIENCE described his welding methods more than 18 years ago—in January, 1942. For the same reason, he forges, rather than casts, the huge gears that drive and maneuver his behemoths. LeTourneau machines rarely wear out. The years just outdate them.

Today's LeTourneau empire, comprising 11,500 acres at Longview alone, got started quite by accident.

Forty years ago LeTourneau was an earth-moving contractor. He didn't like the equipment available. Tractors had to pull scrapers. His machines had to keep going back and forth to move a given amount of dirt from here to there. Tractor-plus-scraper proved clumsy, hard to maneuver.

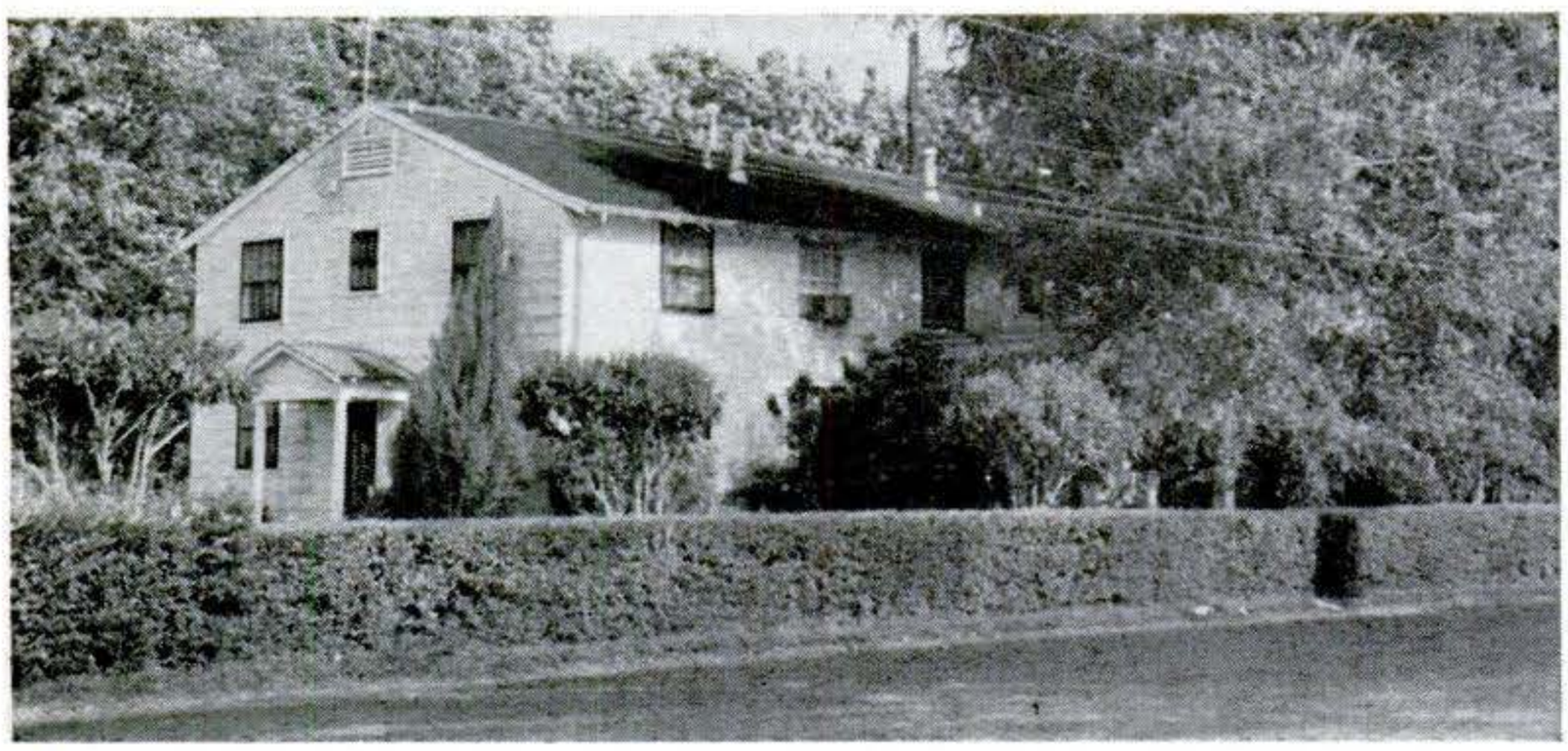
LeTourneau began thinking of a better way to move earth. Why not scoop up dirt in a big bucket and tote it from here to there instead of moving it with a blade? It would be far faster. He began building his own machines. Other contractors began buying them. His buckets were still tractor-drawn, but he had taken a step in the right direction.

While he was coining money in a makeshift manufacturing plant, he kept losing his shirt on earth-moving contracts. Almost consistently underestimating the hardness of the rock he would encounter, he was always only a short step ahead of foreclosure. One job that almost broke him was building the road from Boulder City, Nev., to Boulder (now Hoover) Dam.

Turning point. One day he took stock of himself. He quit moving earth and started making earth-moving machines. That, and a fat contract with Henry Kaiser, was the turning point in his fortunes.

He kept improving his equipment.

[Continued on page 244]



CONVERTED BARRACK serves for what Mrs. LeTourneau calls one of the finest homes she has had in 43 years of meanderings with her husband. It stands on 11,500-acre LeTourneau Texas empire, on part of which blooded Charolais cattle are bred.

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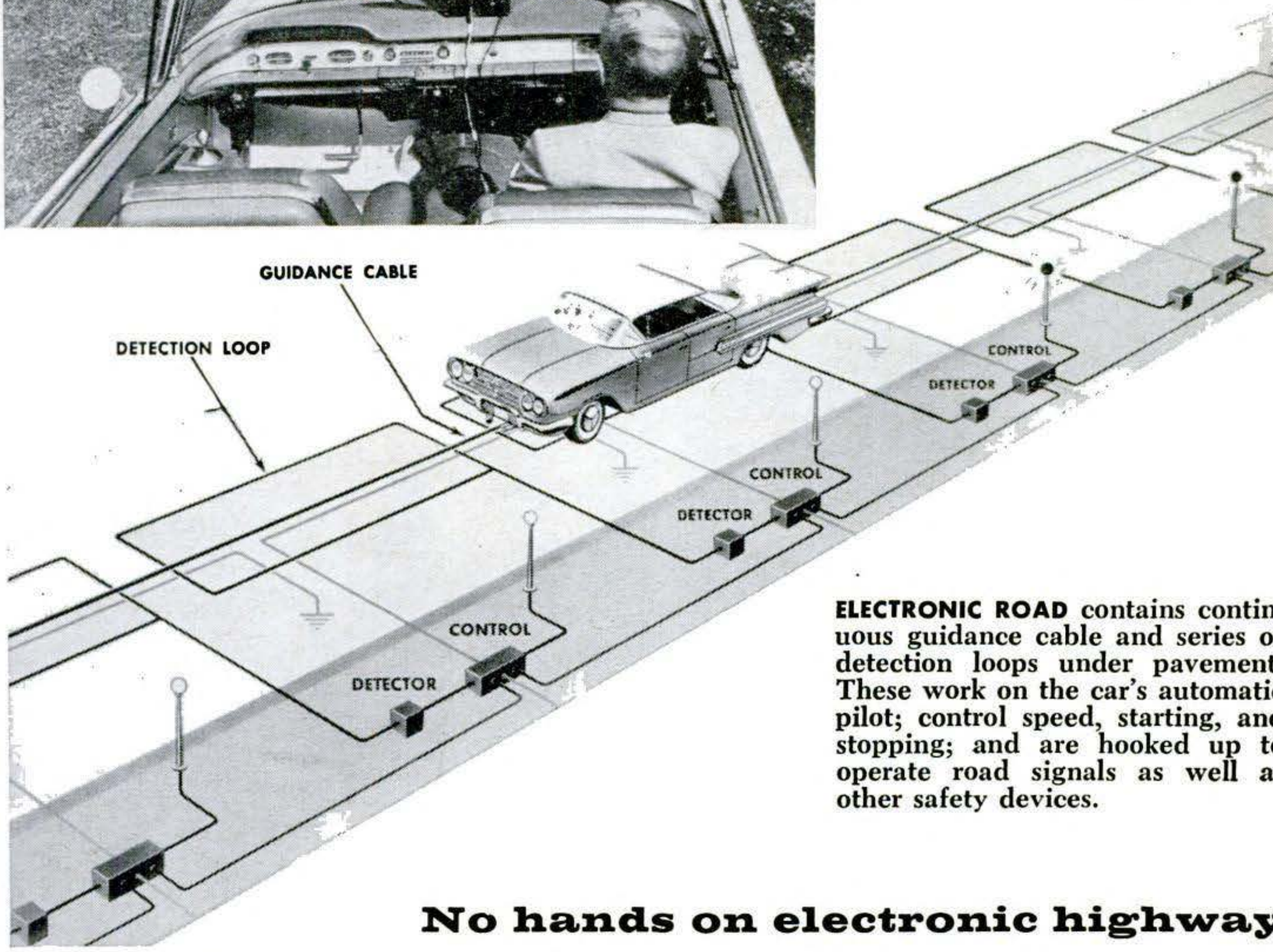
WITH NO STEERING WHEEL, car in foreground at left is kept in lane by guidance wire under the roadway. Built-in controls pick up signals generated by standard car ahead. They speed it up, slow it down, and maintain safe distance between it and the car ahead.



ELECTRONIC ROAD contains continuous guidance cable and series of detection loops under pavement. These work on the car's automatic pilot; control speed, starting, and stopping; and are hooked up to operate road signals as well as other safety devices.

No hands on electronic highway

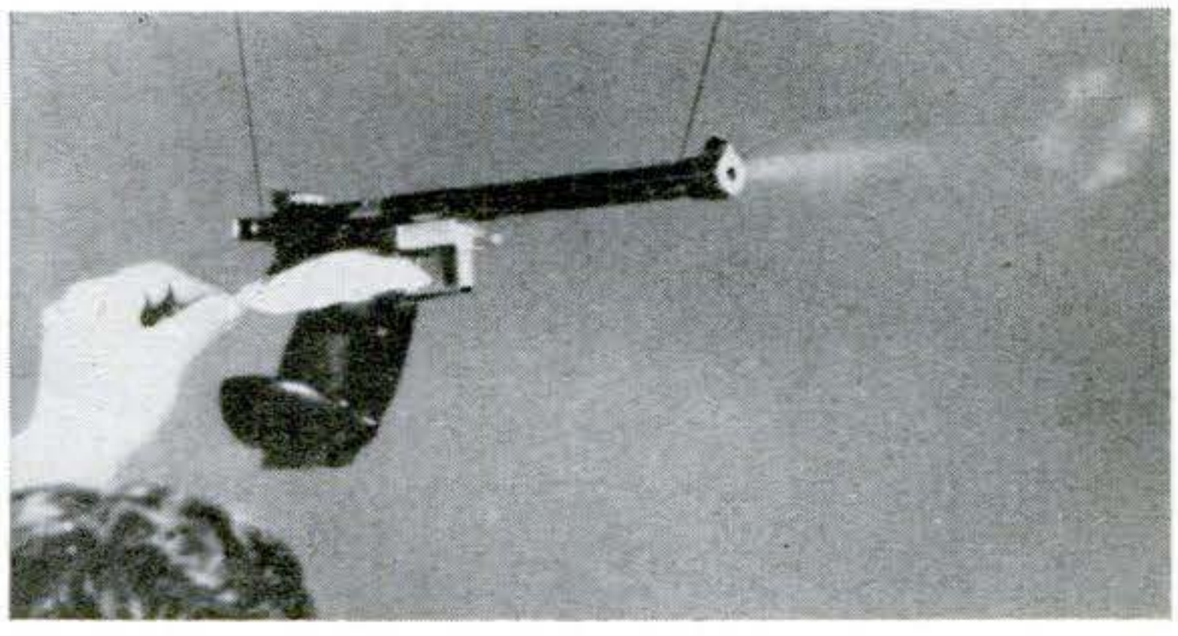
Buried under the asphalt of a quarter-mile-circuit track at Princeton, N. J., is a complete electronic highway-control system that eventually may lead to a revolution in safe driving.

RCA built the highway controls; GM developed and installed an automatic car pilot that responds to them. In a demonstration this summer two cars sped around the track. The lead one—a specially equipped production model—activated the electronic circuit. The other had no steering wheel, was operated entirely by its automatic pilot. It never got nearer than a safe braking distance from the leading car that set the pace.

Quick on the trigger

This electric pistol is so easy to fire that the touch of a feather is enough to pull its trigger.

Action is controlled by a battery-powered electromagnet that replaces the usual mechanical springs and lever. High Standard Mfg. Corp., Hamden, Conn., made the .22-caliber gun for use by the U. S. team in the Olympics free-pistol event.



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How atomic trash men handle a tough and ticklish job:

Getting Rid of Radioactive Rubbish

COLLECTING RADIOACTIVE GARBAGE: Driver and helper double-check cartons of solid waste to make sure they are not too "hot" for highway travel.

LIQUID AND SOLID WASTES are mixed with concrete, poured into 55-gallon, 18-gauge steel drums. Mix is topped with a layer of clean concrete that sets as a protective cap. Job is done at isolated former cement plant, where drums are stored until ready for dumping at sea.

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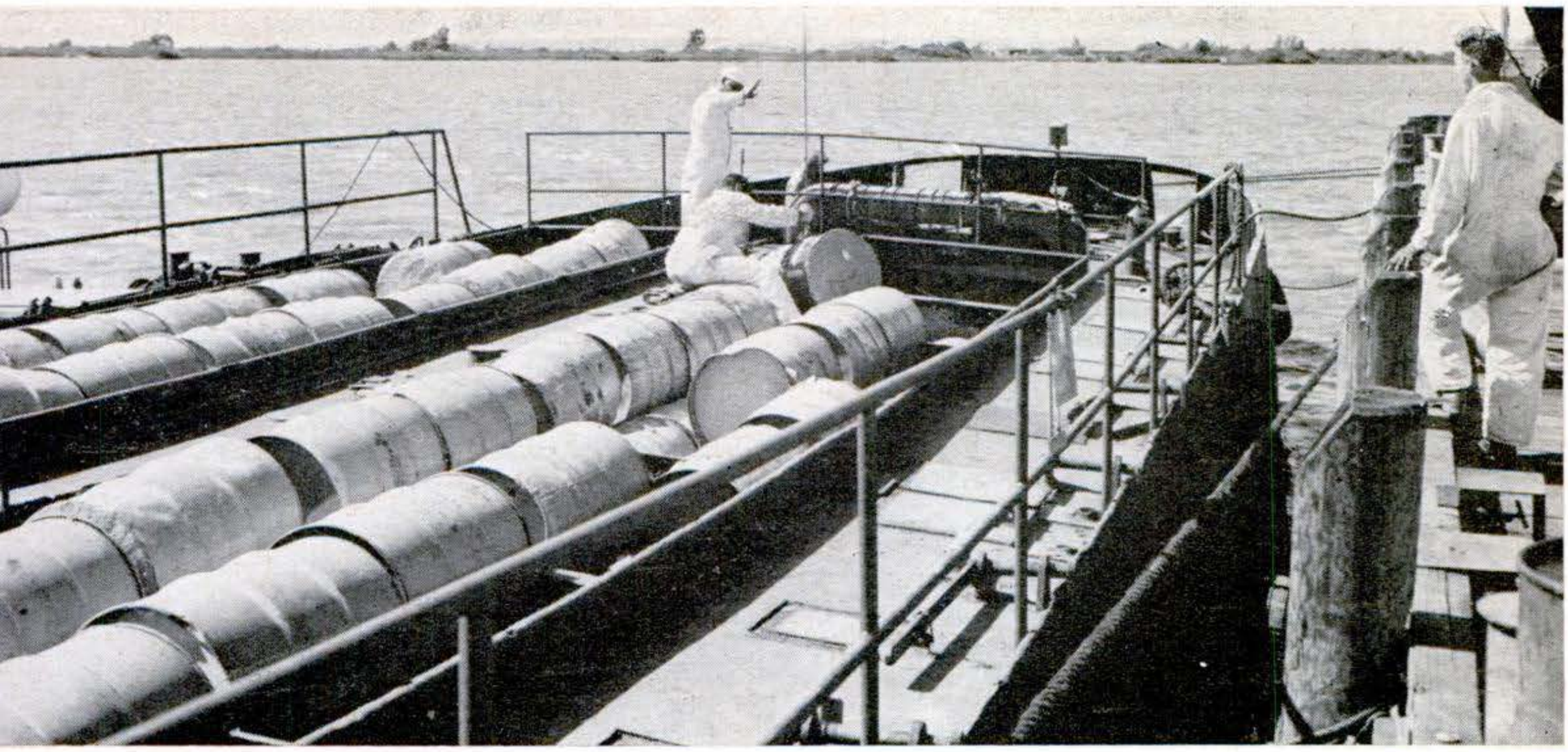

FOR BURIAL AT SEA, hot-waste drums are loaded aboard barge in slanting chutes. Loading takes a day; dumping cargo (in waters 54 miles off San Francisco) needs only 10 minutes.

THE world's most cautious and costly job of trash collection is picking up and disposing of atomic garbage.

The Atomic Age has produced a kind of refuse that can never be casually tossed away. Perilous rays of radioactivity dart from it like an invisible spark and keep much of it dangerously "hot" for years.

The most deadly atomic wastes are collected on Government reservations. The least hazardous radioactive trash, though millions of times less harmful, is still dangerous. It is mostly collected in steel drums and concrete boxes and drowned at sea, miles from shore and at least 1,000 fathoms deep.

Most of the packaged radioactive waste that has been buried at sea has been carried to its grave by the Navy. There are a few "hot" trash men who aren't in uniform, however.

A typical commercial outfit is the Nuclear Engineering Co. Its nuclear-trash collectors go about in white coveralls and skullcaps, and sometimes in masks. They wear film badges and carry pocket dosimeters, for measuring their exposure to radiation. Recently I called on that company's chief engineer, J. S. Corbett, to find out about his strange business.

Corbett's office is in the little town of Pleasanton, Calif., a few miles southeast of Oakland. From the start of our talk, he made it clear that, ticklish as his usual trade is, it is by no means perilous.

"When people hear the word 'radiation,'" he said, "they immediately think of an atomic bomb. Why, I'd rather ride on our van loaded with radioactive waste than on a truck carrying gasoline or explosives."

How dangerous is it? You could stand beside the van or follow it with no more risk than you'd run by wearing a wrist watch with a luminous dial, Corbett said.

That is, he added, you could if the truckload's radiation is under the low limit set by the A.E.C. If it isn't, the truck can't move until the limit is met.

"You could even park beside one of

AT ATOMIC DUMP SITE, drift cards are tossed overboard to determine pattern of surface currents. Weighted at their bases, red-and-white-striped cards float like little sails.

CONTINUED

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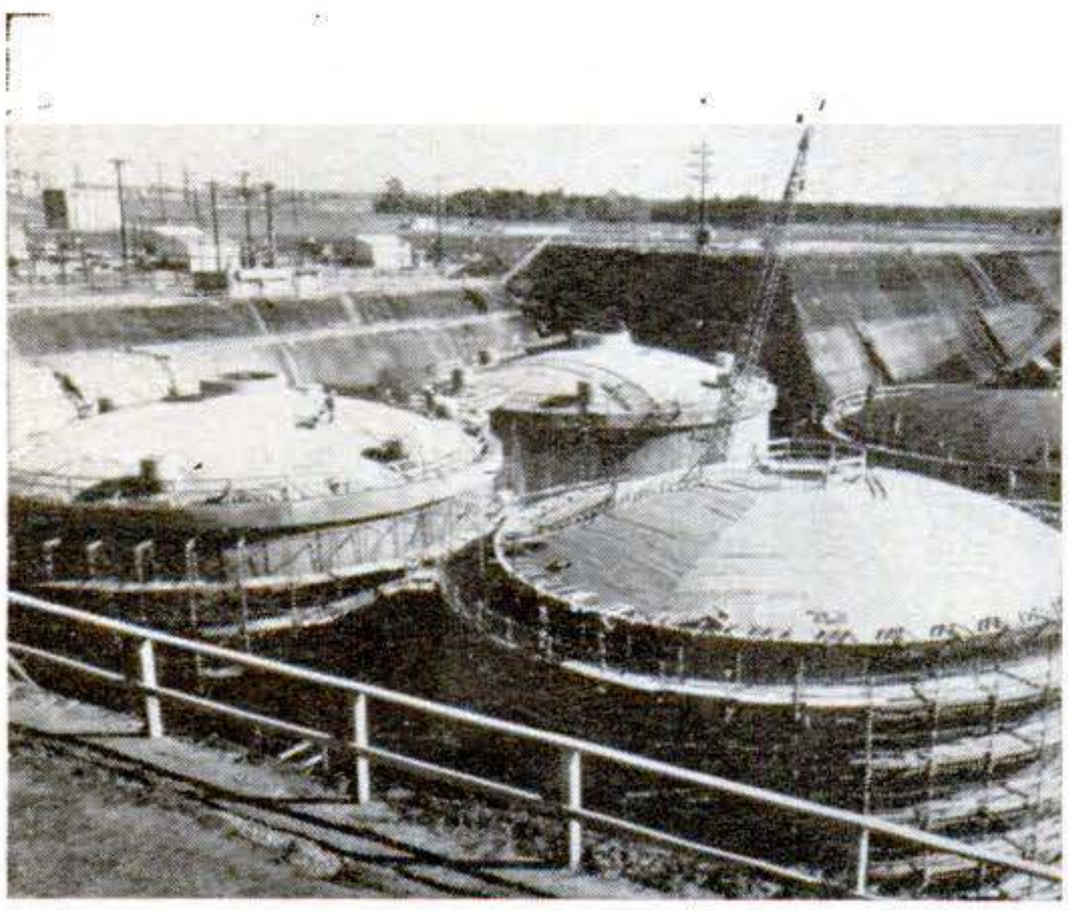
GRAVEL-FILLED TRENCHES are used to let liquid waste percolate into dry soil at the Hanford, Wash., atomic-energy plant. Here perforated pipe to carry waste is being laid down.

MAJOR BURIAL GROUND in the East for solid radioactive waste is Oak Ridge reservation. Containers are covered with at least three feet of dirt. Five acres of land a year are used.



HUGE CONCRETE-AND-STEEL TANKS are used to store extra-hot waste at Savannah River plant. Tanks, 85 feet in diameter, 34 feet high, rest on steel saucers and six-inch concrete pads.

our loaded trucks for hours—which we wouldn't permit, by the way—and receive less radiation than you'd get from one chest X-ray," Corbett told me.

To make pickups, the Nuclear Engineering Co. sends out two trucks: a 25-foot stainless-steel van for solid waste, a 2,600-gallon tanker truck for liquids. The trucks collect hot trash from customers who are users of radioisotopes—hospitals, colleges, manufacturing plants, labs.

Solid wastes usually are waiting in wooden boxes, fiberboard containers, or 55-gallon steel drums. They are a mix of radioactively contaminated objects, mostly small. They include swabs, paper towels, mops, lab clothes, broken glassware, animal carcasses, irradiated lathe turnings, tools, and parts of test equipment. Even though the containers have all been monitored for radiation before the atomic garbage men arrive, they recheck them with a radiation counter. They can't risk losing their employer's license by carrying trash too hot to travel safely.

Liquid waste is mostly water, a bit too contaminated to be allowed to go down a drain. It costs the customer plenty—from 60 cents to $1 a gallon—to get rid of it. Its radioactivity is low-level. One cubic centimeter must be 100,000,000 times less hot than a gram of radium.

The trucks carry bright signs that read, "Dangerous Radioactive Material." They are like a dog's growls—demanding wary respect but not justifying fright.

At Cowell, Calif., is the processing plant. It's a former cement plant isolated among low hills. Wastes are mixed together with cement and poured into steel drums. The mix is capped with 6 to 12 inches of clean concrete. For this hazardous job of mixing the least desirable concrete on earth, the men wear two pairs of coveralls, canvas shoe covers and rubbers, plastic gloves, caps, and filter masks. Clothing can be worn only once before being decontaminated.

The A.E.C. permits Nuclear Engineering Co. to store liquid wastes for as long as three months, and solid wastes for 21 months. Cowell is ideally suited for its odd new uses. It consists of four great bays, 250 feet long and 30 feet wide, with concrete walls 4 feet thick at the base. Concrete is a good radiation shield.

Dumping time comes once or twice a

[Continued on page 260]

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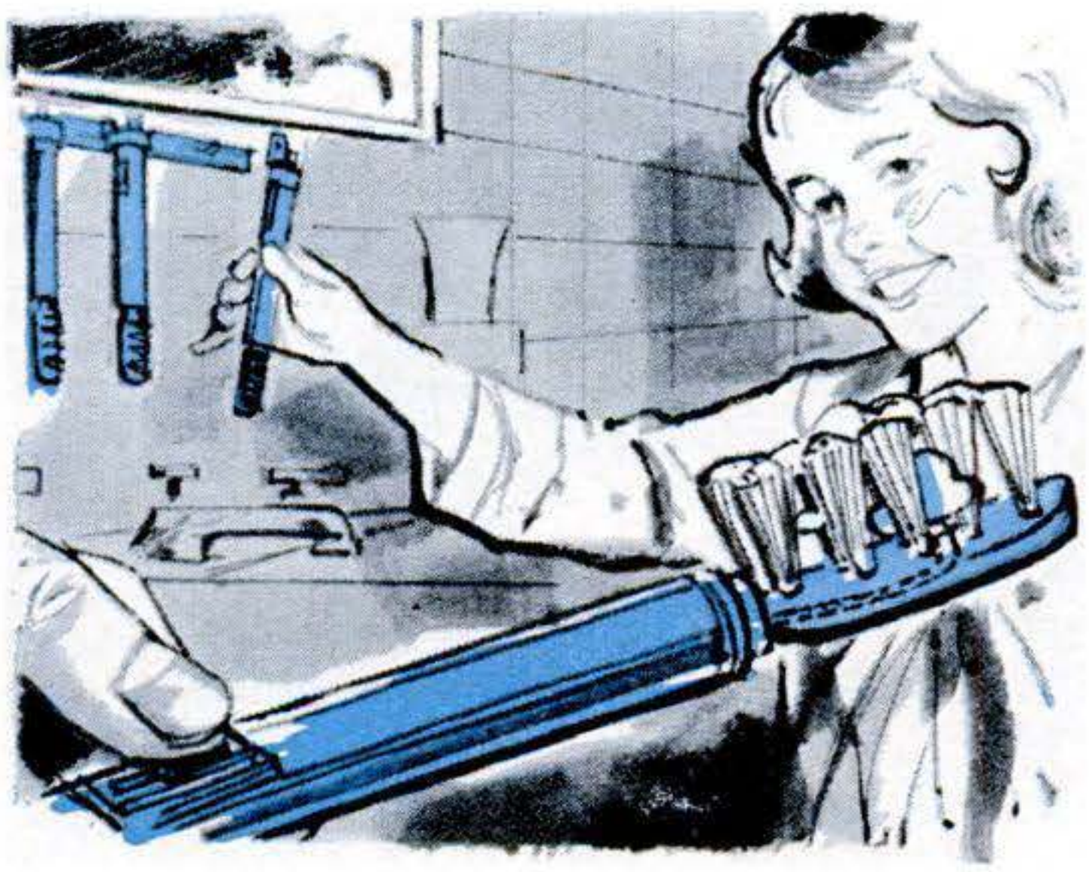
New Ideas from the Inventors

Fans Halt Fire Spread. Forest fires are usually spread by wind, including the draft caused by a fire's own heat. But counter-winds might confine a blaze so it could be fought. This recent patent would use mobile 100-m.p.h. shrouded fans to control the spread. They could be self-powered or driven by truck engines.

Toothbrush Feeds Its Own Paste. A toothpaste tube couldn't spread germs from brush to brush if each brush fed itself from a sanitary supply in the handle. A piston would force paste through a narrow passage and eject it from an outlet at the base of the bristles.

Poisoned Nail Fights Termites. The insect poison pocketed in the lower end of this two-headed nail might help you combat wood borers. You'd sink it to the first head, pull the exposed one (with its sleeve) to break the seal, and hammer again to force poison into infested wood.



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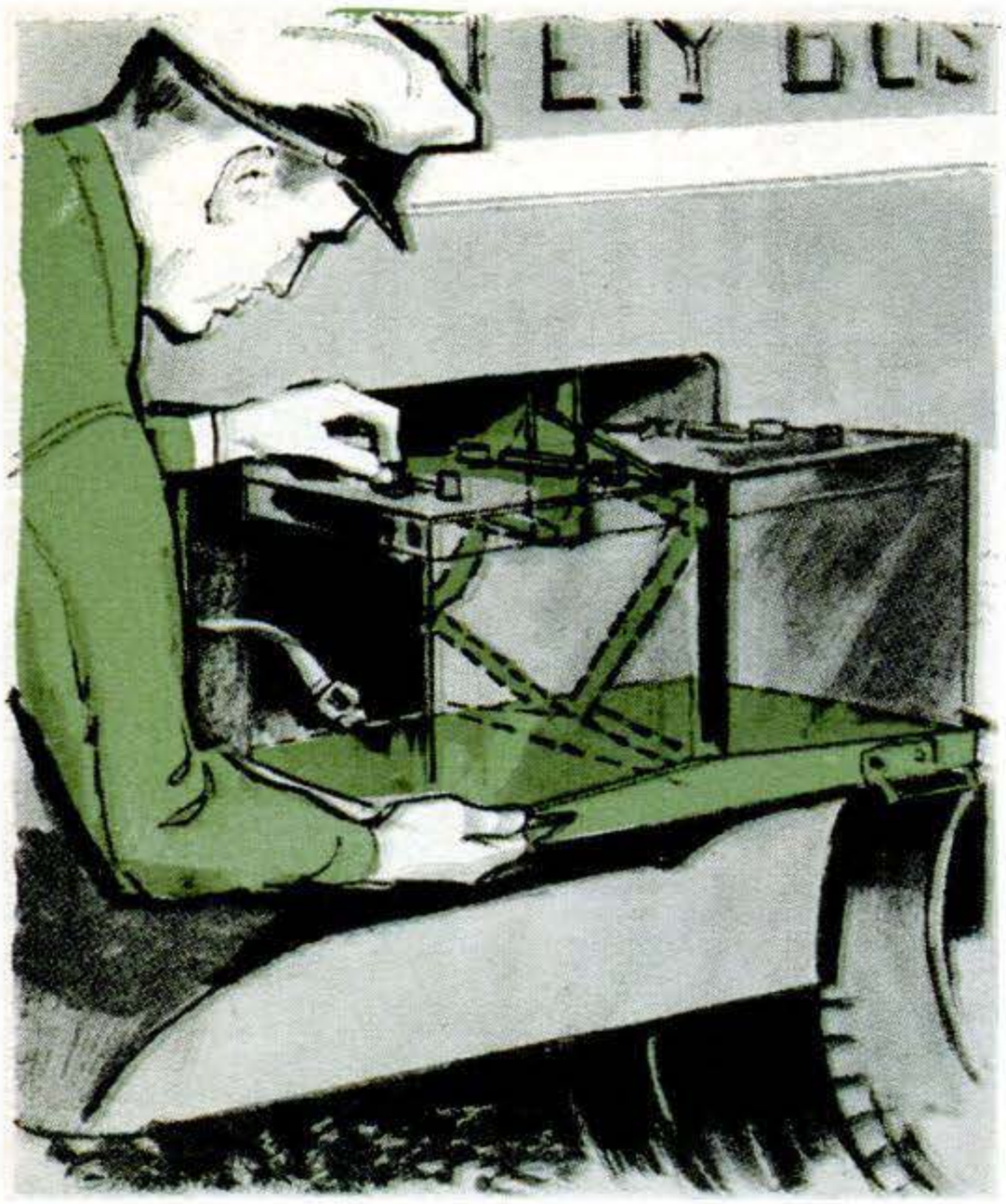
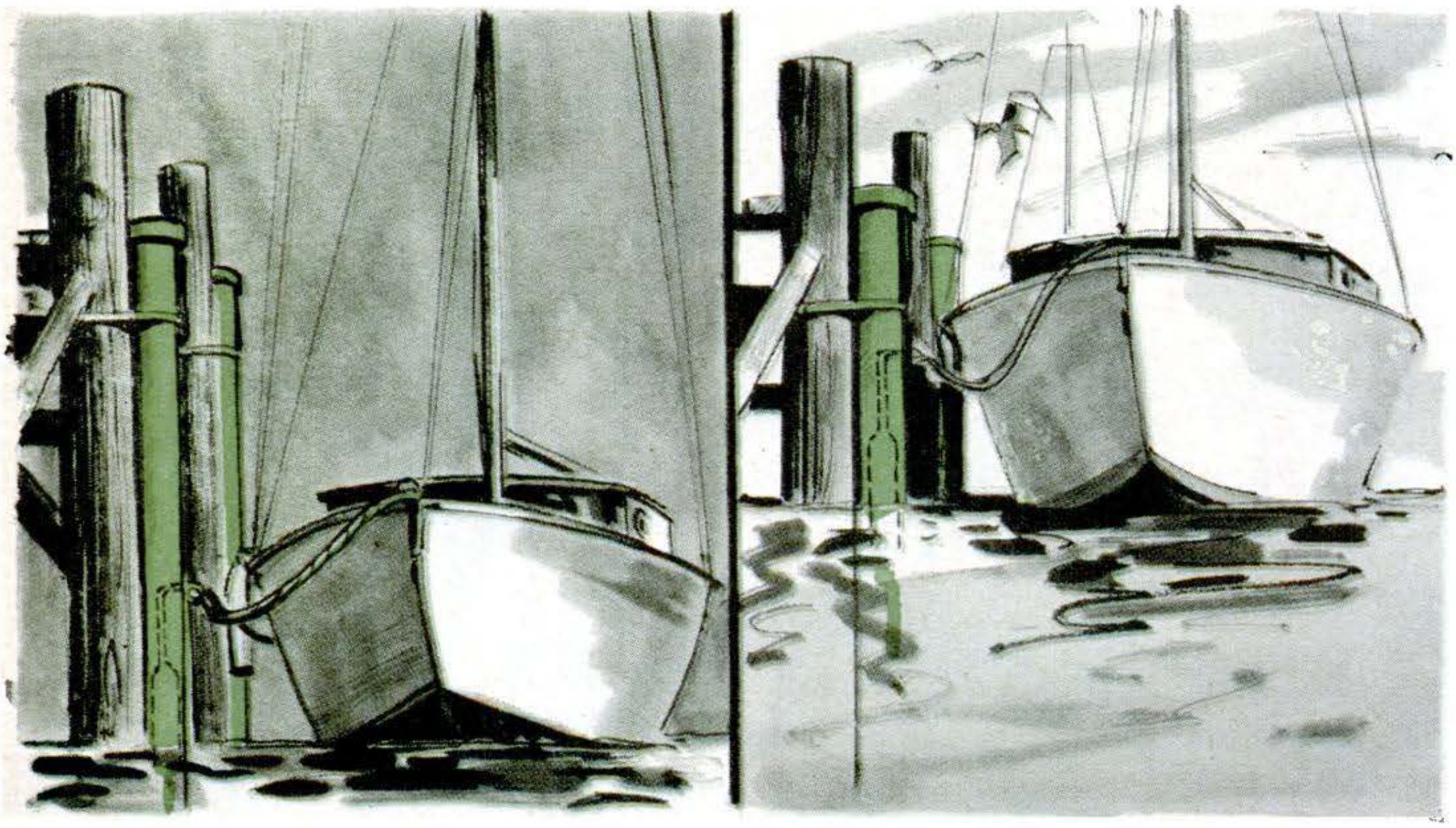


Retractable Shelf Exposes Battery. Truck or bus batteries could be checked and serviced more readily if they came out to meet the serviceman halfway. With a supporting platform fastened to balanced, parallel arms, batteries could be easily moved out of their compartments.

Wheel Guides Paint Roller. With this adjustable guide wheel to help maintain a spaced distance, you could use a paint roller on a ceiling without streaking the adjoining wall, and vice versa. A thumbscrew would let you rotate or extend the guide-wheel bar to suit the job.

Mooring Post Adjusts for Tides. A float inside this hollow, dock-mounted mooring post would rise or fall with the tides, so you could tie up snugly at any hour. Eliminating rope slack would simplify mooring, make it easier to board or leave the craft, and reduce the chance of fouling or bumping other boats.



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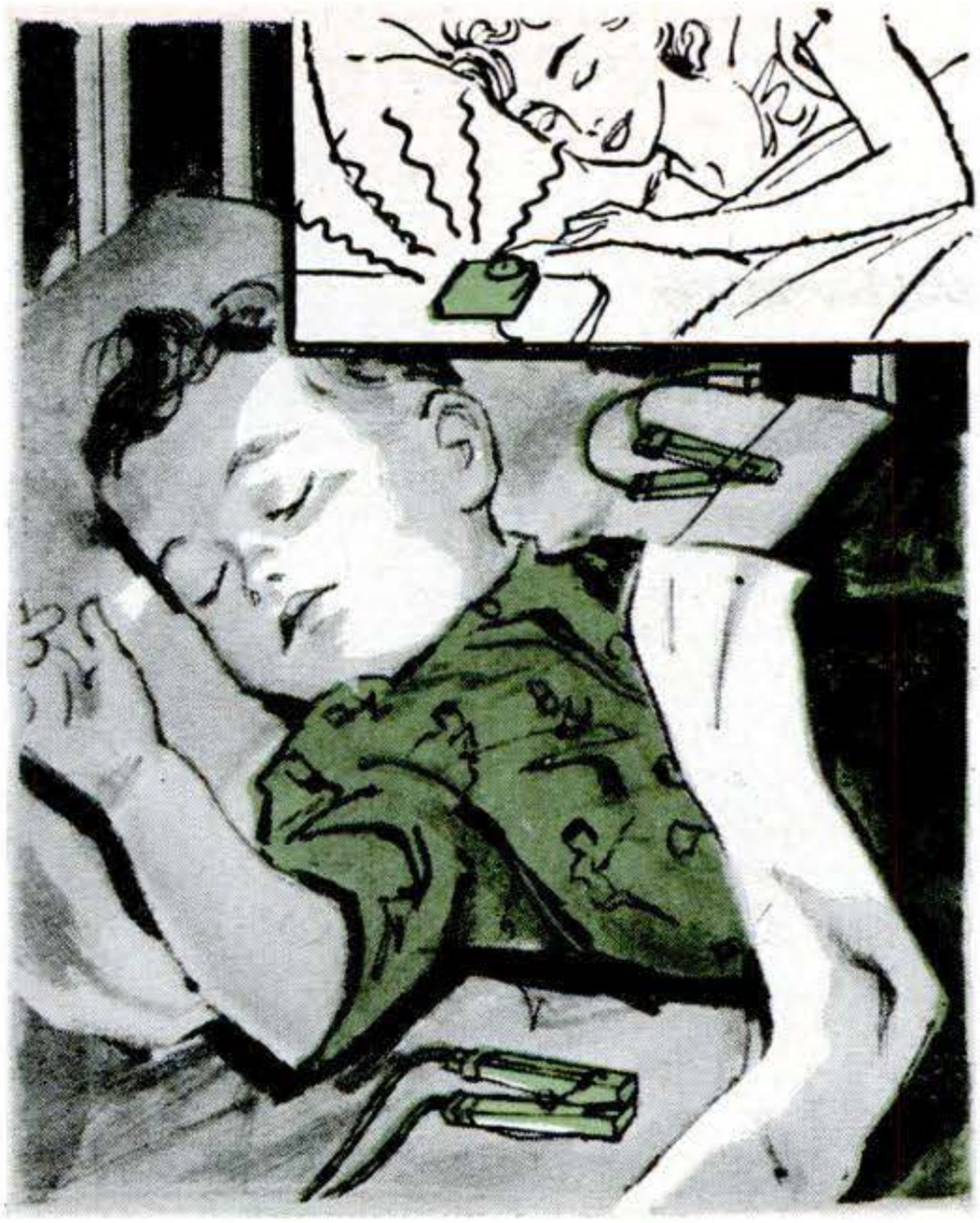

Clips Tell if Baby's Uncovered. A mother would know if or when her infant had kicked off a crib blanket that was held by these contact-tipped spring clothespins. Pulling the cover from between the jaws of the clip would close a simple battery-powered bell circuit.

Sonic Saw Cuts Stones. Rocks could be cut more smoothly and accurately, says this inventor, by vibrating a hatchet-shaped cutter at speeds up to 100,000 back-and-forth movements a second. Generated by an ultrasonic oscillator, the small but rapid pulsations would produce both abrading and splitting actions. A water spray would cool the blade.

Fluid Stilts Raise Man to Job. An aircraft or construction worker could walk to high-up work areas on these telescoping hydraulic stilts. Once his legs were strapped in, working a valve would lengthen or shorten the stilts as he stepped from one foot to another.

The following patents have been issued on these inventions: **Fire fan**—*No. 2,891,624 to L. C. McBride, Inglewood, Calif.;* **Piston toothbrush**—*No. 2,908,925 to J. Reitknecht, NYC;* **Termite nail**—*No. 2,923,039 to R. E. Imus, Sierra Madre, Calif.;* **Battery shelf**—*No. 2,802,540 to G. E. Brookbank, Rochester, Mich.;* **Roller guide**—*No. 2,797,427 to S. D. Tate, Cumberland, Ky.;* **Mooring post**—*No. 2,808,016 to F. R. Jarnot, Bridgeport, Conn.;* **Crib clip**—*No. 2,908,899 to D. B. Crafts, Auburn, Me.;* **Sonic cutter**—*No. 2,831,668 to R. F. Skowronski, Elmsford, N. Y.;* **Hydraulic stilts**—*No. 2,923,947 to F. T. Weighill, Port Hueneme, Calif.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

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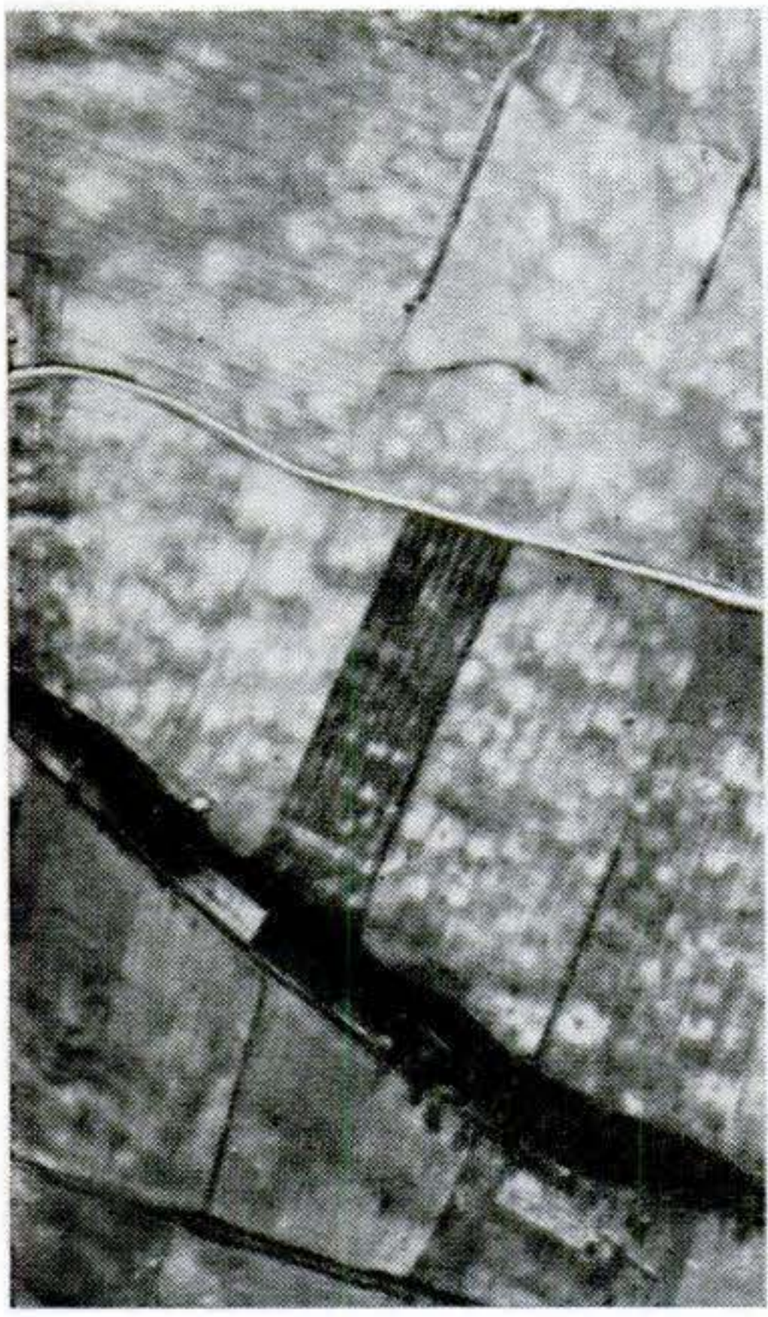
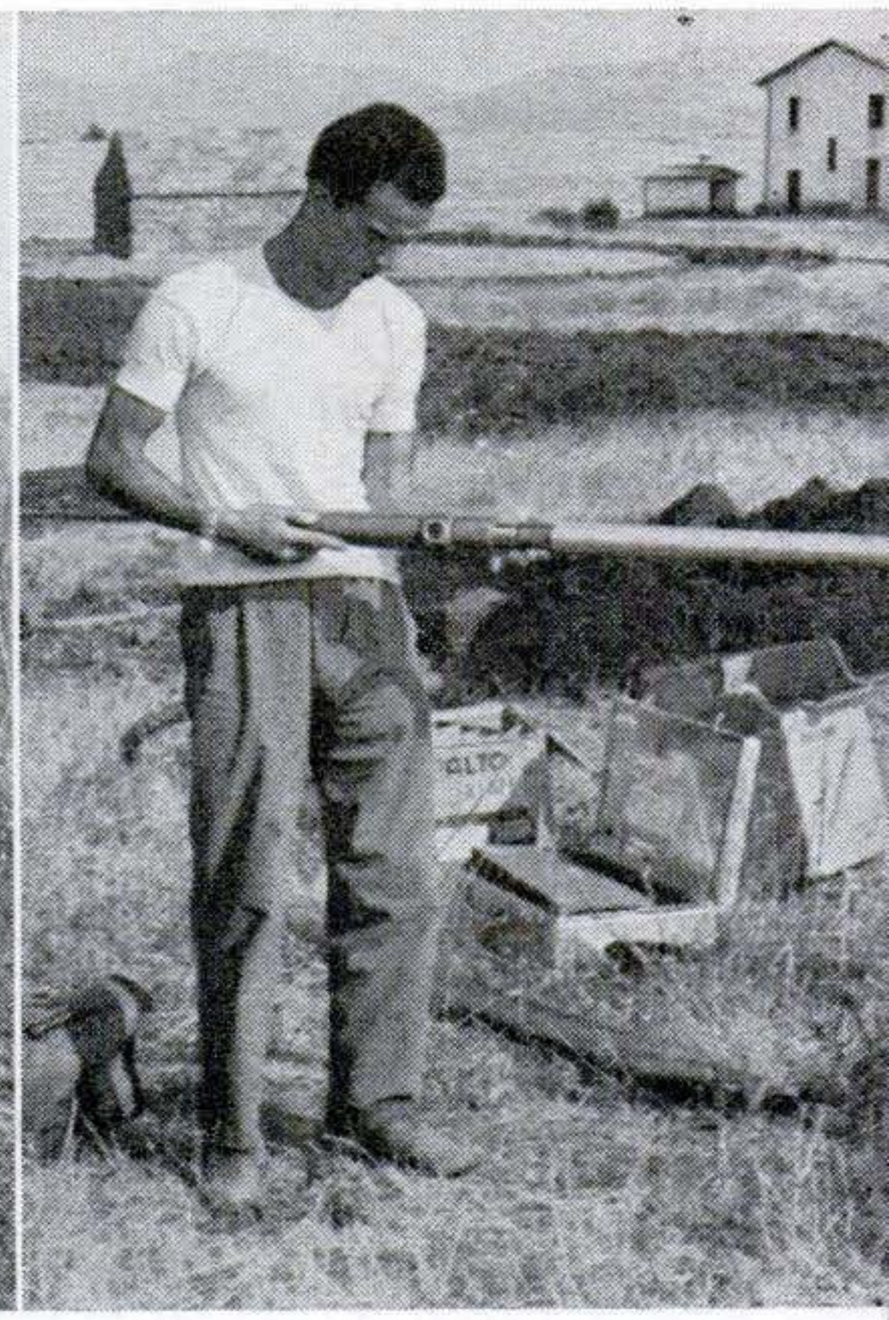
Archaeologists' scientific grave-robbing unearths



BURIED ETRUSCAN TOMBS show up as white spots in air photos over Tarquinia, Italy.

FIELD WORKERS drill into the roof of a tomb. Electrical soundings help pinpoint sites.



TINY CAMERA, called the "Eye of Minos," fits behind the round window in an aluminum tube.

New Tools Probe Riddles

FORTY miles north of Rome, archaeologists unearth a rare find—a treasure-filled Etruscan tomb 2,500 years old. The find is no accident. An underground camera told them precisely where to dig.

Outside London, workers comb the countryside with what looks like surveying equipment—tripod and all. At a spot where the indicator needle jumps dramatically they dig—and find a 2,000-year-old Roman kiln buried below.

In New York, a physicist teases some Mayan pottery in a nuclear reactor. It gives off gamma rays. The rays link the pottery to pieces found hundreds of miles away, thus mapping an ancient—and unsuspected—trading route.

Archaeology, traditionally bound by the luck of the spade in its pursuit of man's past, is suddenly acquiring modern tools and techniques that are taking some of the chance out of the chase. Significantly, besides giving the archaeologist vastly improved ways of studying the fragments he's dug up, the new methods actually tell him *where* to dig.

Scientific grave digging. Take the Etruscan tomb. It's part of a cemetery that literally came to light through aerial photography. R.A.F. reconnaissance shots taken during World War II showed whitish pock-marks on terrain outside Tarquinia—a city built on the ruins of one of the richest Etruscan towns of antiquity. The pale circles, too faint to be visible at ground level, were the outlines of the lavish tombs the Etruscans fancied. The hollowed-out chambers lessened the fertility of the soil and made surface plants above them lighter in color.

The air pictures neatly plotted the cemetery but fell short of pinpointing individual tombs. Again instruments took

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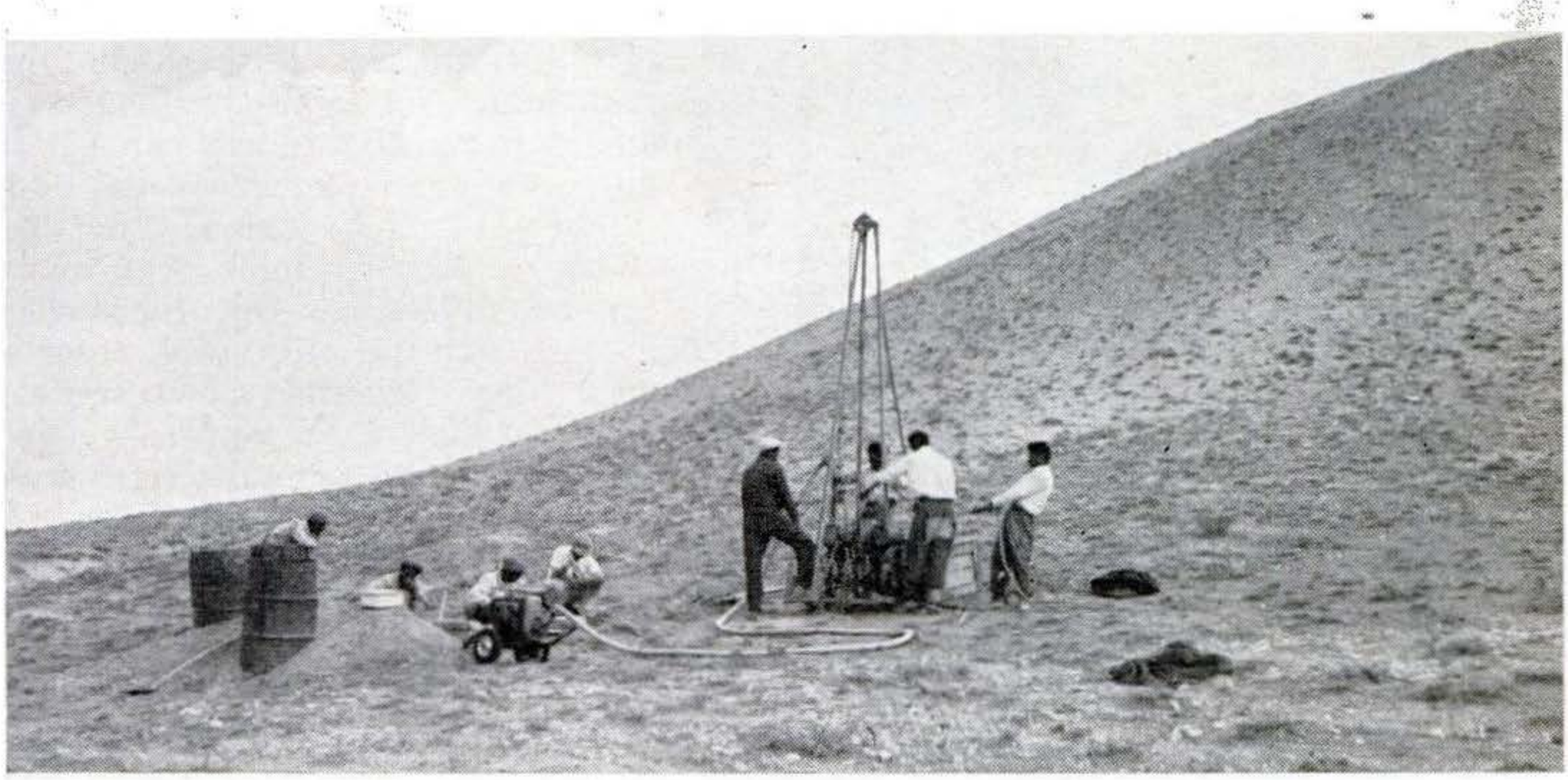
Etruscan riches

PEERING at 2,500-year-old tomb paintings, viewer triggered the camera, got shot at right.

# of Man's Past

By Joan Steen

Oil drills discovered this ancient tomb



KING MIDAS' TOMB? Earth heaped 170 feet high covers this huge tomb at Gordion in the Middle East. Archaeologists of the University of Pennsylvania used oil-drilling rigs to test-bore the mass. Without this equipment they would never have tackled the giant mound.

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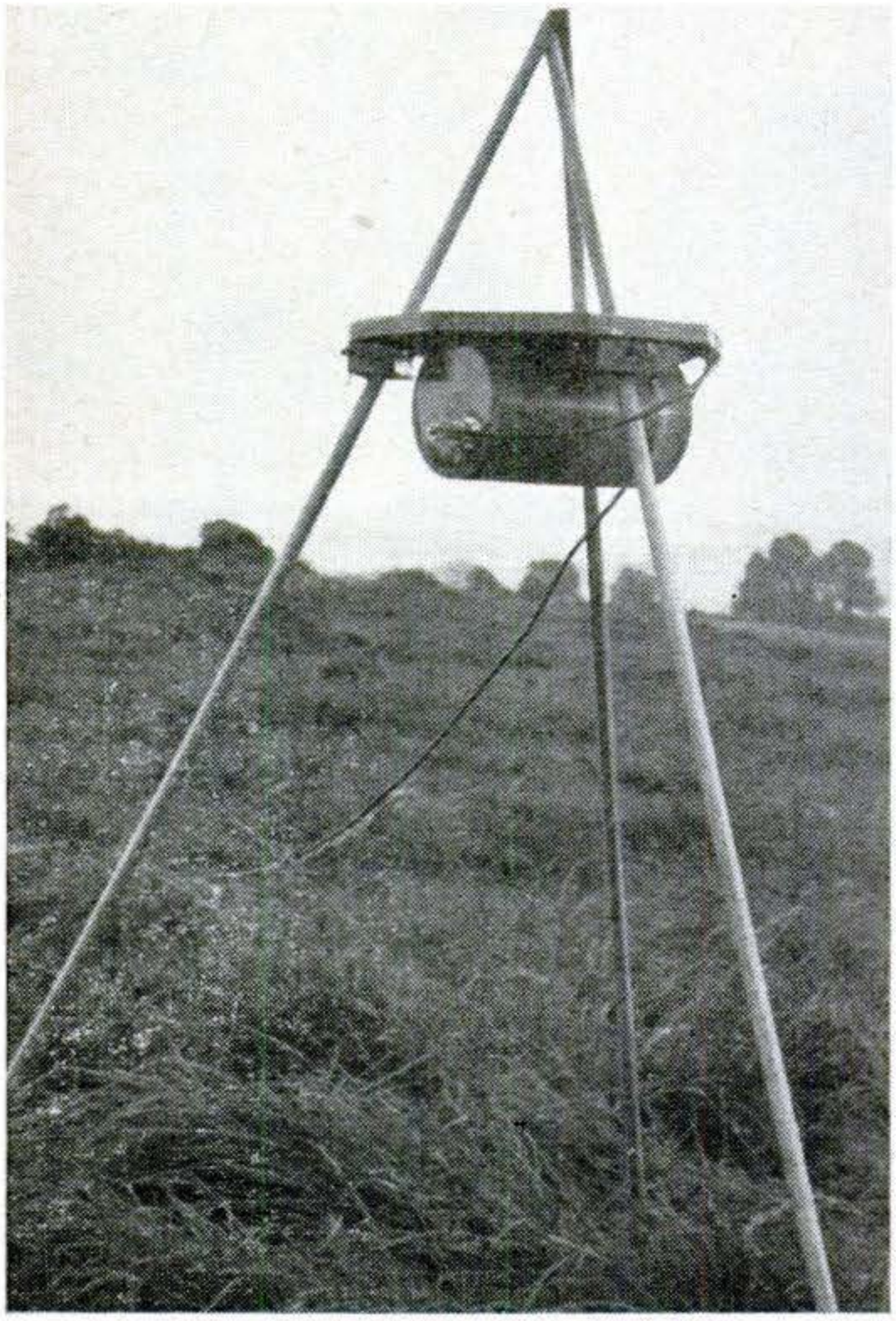
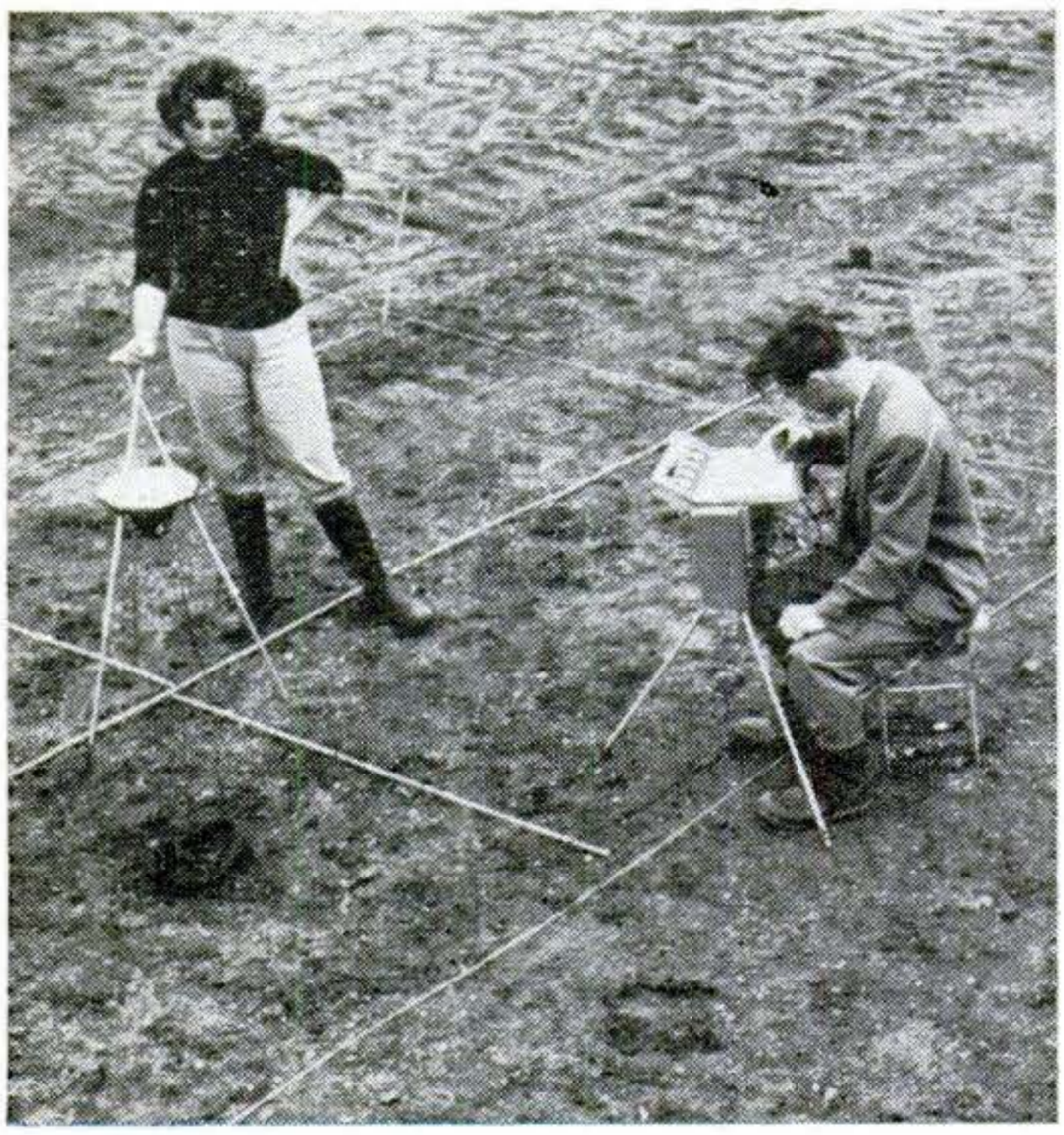
Magnetic divining rod finds Roman ruins



HEART OF PROTON MAGNETOMETER is a half-pint bottle of water wrapped around with a thousand-turn wire coil. Hydrogen protons in the water kick up when in a magnetic field.



CLOSING IN on a find in English countryside, Oxford scientists take magnetometer readings off what may be an old Roman pottery kiln, its clay still magnetized from firing.

over. A photometer picked up the differences in grass color, while a potentiometer compared electrical resistances in the subsoil: higher where there were air spaces or objects inside tombs; lower where there was solid earth only.

Old skull-duggery. Still a crucial problem remained. Which tombs were worth digging up? Thieves have ticked off 99 out of every 100 Etruscan tombs, according to Carlo Lerici, the geophysicist who headed the Italian team. His ace-in-the-hole here was the underground camera. A Minox with a high-intensity flash attachment was fitted into an aluminum tube. This was dropped through a hole drilled from the surface down into the tomb roof. Viewers could use a special periscope to decide if the tomb was worth photographing, then remotely aim and trigger the camera tube.

At tomb 53 the camera paid off. Color films showed superb wall paintings of Etruscans decked out for athletic games: chariot-racing, running, discus-throwing. One very gory panel even hints at Rome's later gladiatorial contests. It shows a hooded man armed with a club pitted against a savage dog.

The vogue spreads. While the tiny camera has so far been limited to stalking the elusive Etruscans (authorities still haven't cracked the mystery of who they were or what language they spoke), the other techniques have spread: In the craggy desert terrain of the Near East air maps are invaluable. At Gordion, the city of the fabled (but real) King Midas, oil-drilling rigs replaced laborious trench-digging in spot-checking the ground for ruins. If the drill came hard against rocks a few feet down, the odds were they were piles of stones that had been heaped up over a tomb.

Magnetic detecting. But these procedures are not the only new ways of finding a "dig." Scientists at Oxford are excited about the "magnetic prospecting" technique they used to find that Roman kiln.

The magic divining rod here has the impressive name of "proton magnetometer" and its success has to do with the mysterious qualities of baked clay.

The heart of the P.M. couldn't be simpler: a half-pint bottle of water wound round with a thousand-turn wire coil. The water provides hydrogen protons

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How old is old clay? Check its magnetism

SKILLED HANDS box a sample of old clay unmoved for centuries. Scientists (right) use surveying equipment to mark present-day readings of true and magnetic north on the sample. Back in the lab, the old clay's baked-in magnetic direction will be checked against the modern data. The differences will be used to date the time of its firing to within 25 years.

which gyrate in a magnetic field. The kiln provides the field by virtue of the strange habits of the magnetic iron-oxide particles in the kiln's clay walls.

When the clay is cold the particles point sluggishly in random directions—all but canceling their total magnetism. But when heated (up to 1,300 degrees in a kiln), the particles line up in the direction of the earth's magnetic field—and *stay* lined up after the clay has cooled.

When the magnetometer points toward such a field the protons in the water bottle spin briefly—just enough to generate the whisper of voltage in the wire coil (about a millionth of a volt) that makes the needle jump.

A race against time. The story of the first application of the P.M. is a wonderful account of archaeologists getting the jump on progress. "Progress" meant a road—to be built leading north from London. The archaeologists knew there were Roman settlements in the area and needed a fast way to find them before earth-moving equipment would hopelessly churn up the land. Racing against bulldozers at their heels, they pressed their survey. The results were a triumph. The P.M. faithfully ferreted out kiln areas which were then set aside for study.

Since that time the magnetometer has chalked up other victories. It's so sensitive that it reacts to fields weaker than kilns: domestic hearths, houses destroyed by fire, old rubbish pits.

It even senses the very feeble magnetism of the cold iron oxide in the soil itself. Here a happy quirk of civilization helps. Man magnetizes the soil. Where he lives (and dies) he leaves a layer of topsoil enriched by humic acids from decaying animal and vegetable matter. The acids apparently convert the iron oxide to a more magnetic form and thus enable the P.M. to sniff out former lived-in areas.

Magnetic dating, too. Once archaeologists have set up camp at a dig they face the job of dating the findings. Enter a magnetometer again—this time with a slick way of telling how old clay objects are, to within 25 years. (Compare that with radioactive-carbon dating which counts time in terms of the known rate of decay of the carbon 14 isotope. It allows a leeway of a couple of hundred years.)

The key to magnetic dating is the earth's own magnetism. It constantly changes direction from place to place and time to time. Old clay objects have baked

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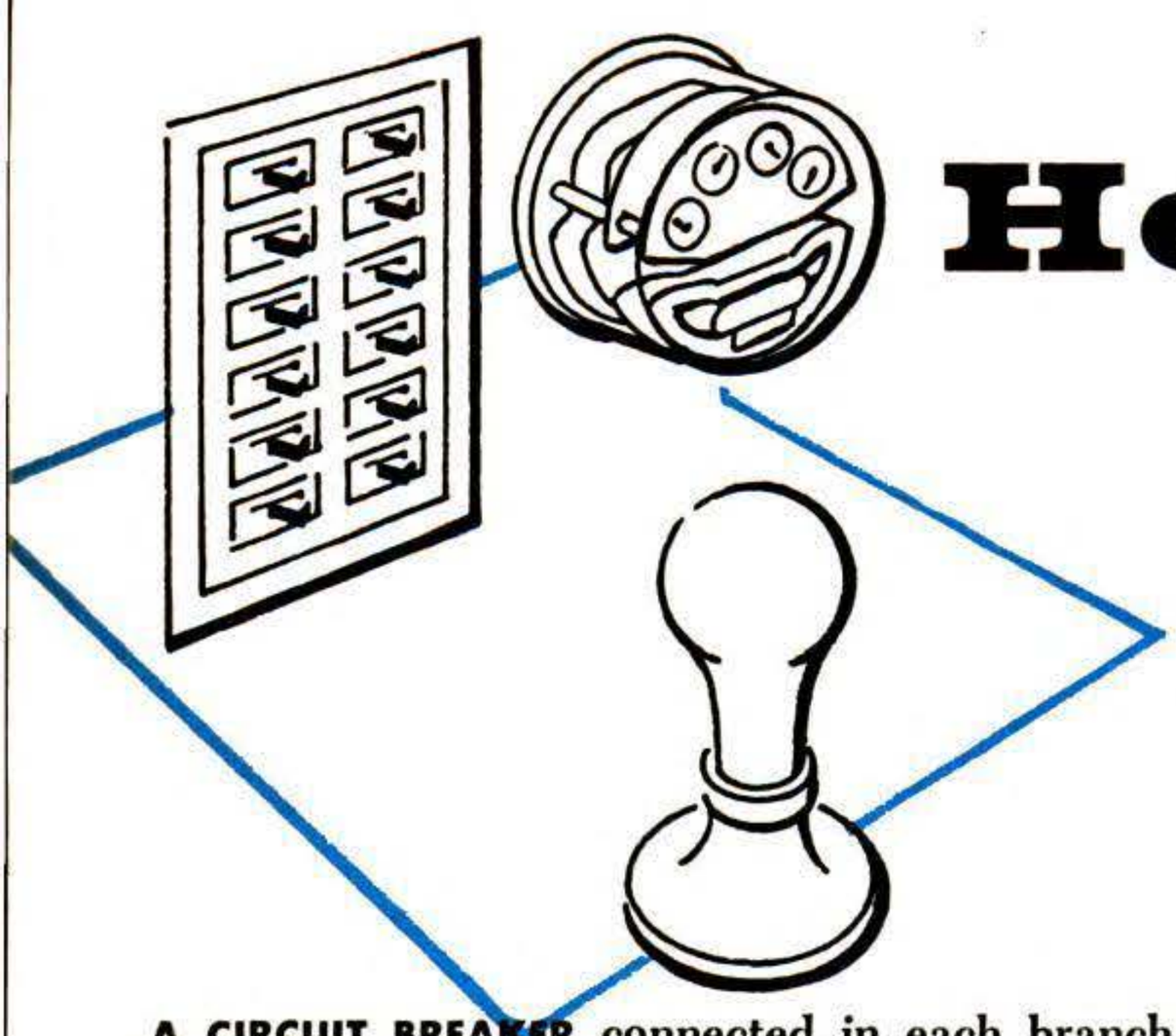
How Circuit



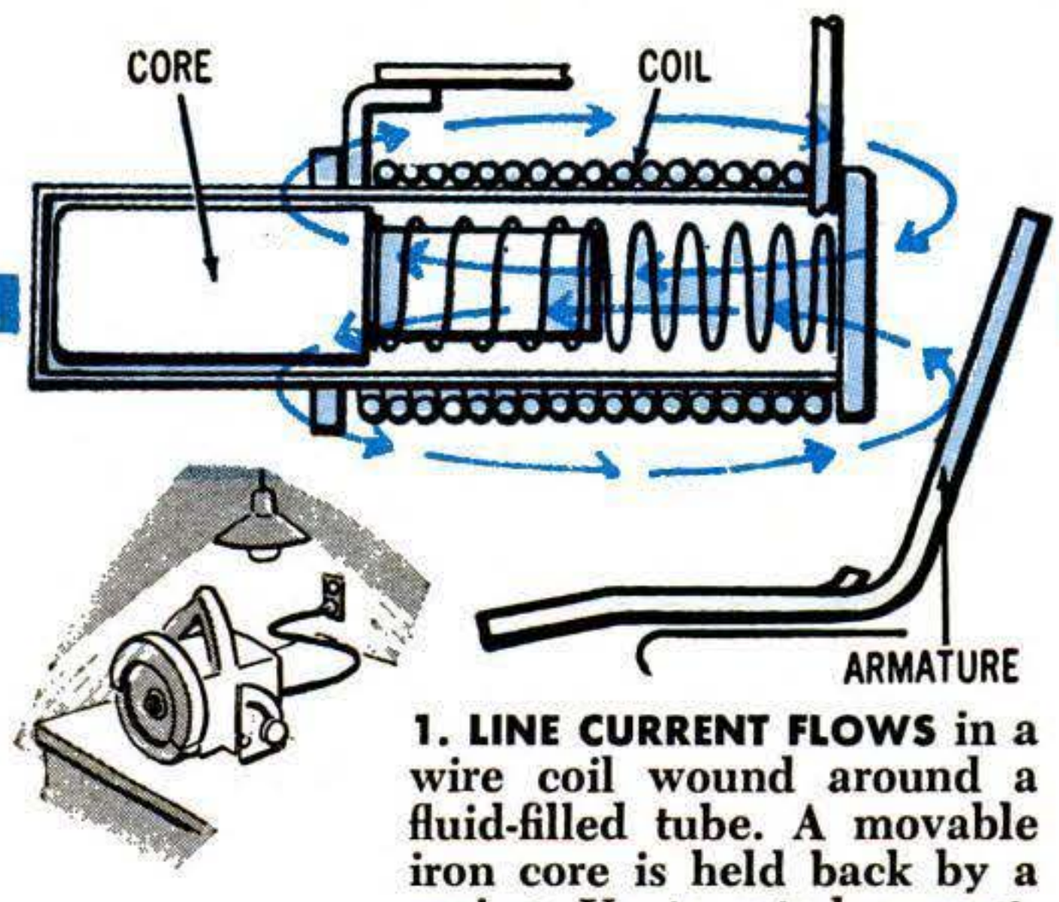
A CIRCUIT BREAKER connected in each branch line polices current flowing in it. Grouped on a panel, breakers look like wall switches.

LIKE fuses, residential circuit breakers watch over electric lines to cut off power if too much flows. Unlike fuses, breakers needn't be replaced, but are simply reset by flipping a toggle. If the cause of excess current remains, the breaker snaps open again.

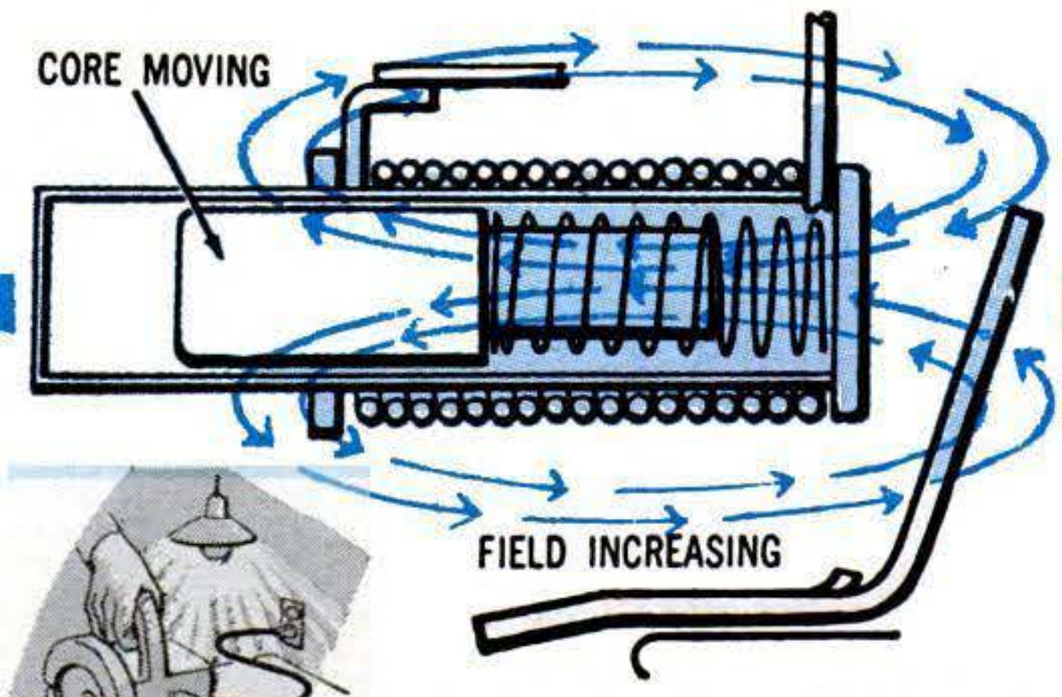
Circuit breakers being permanent, no spares need be kept on hand. They expose no live sockets to unwary fingers, cannot be doctored to carry more current than they should. Thus many new homes are fitted with breakers instead of fuses.

Earlier breakers depended on the heat-

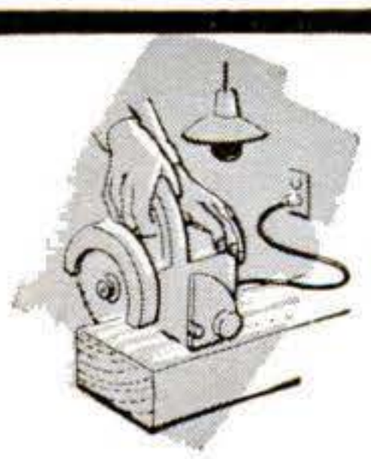
Fully magnetic breaker has a built-in hydraulic time delay



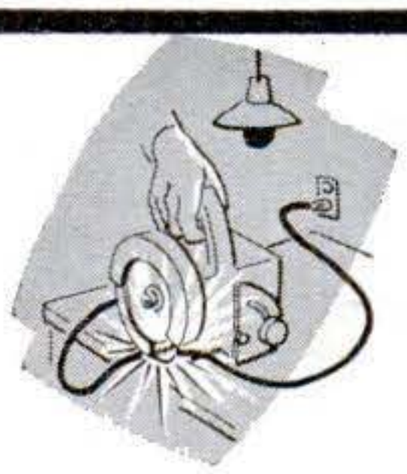
1. LINE CURRENT FLOWS in a wire coil wound around a fluid-filled tube. A movable iron core is held back by a spring. Up to rated current, the magnetic field is too weak to move the core.



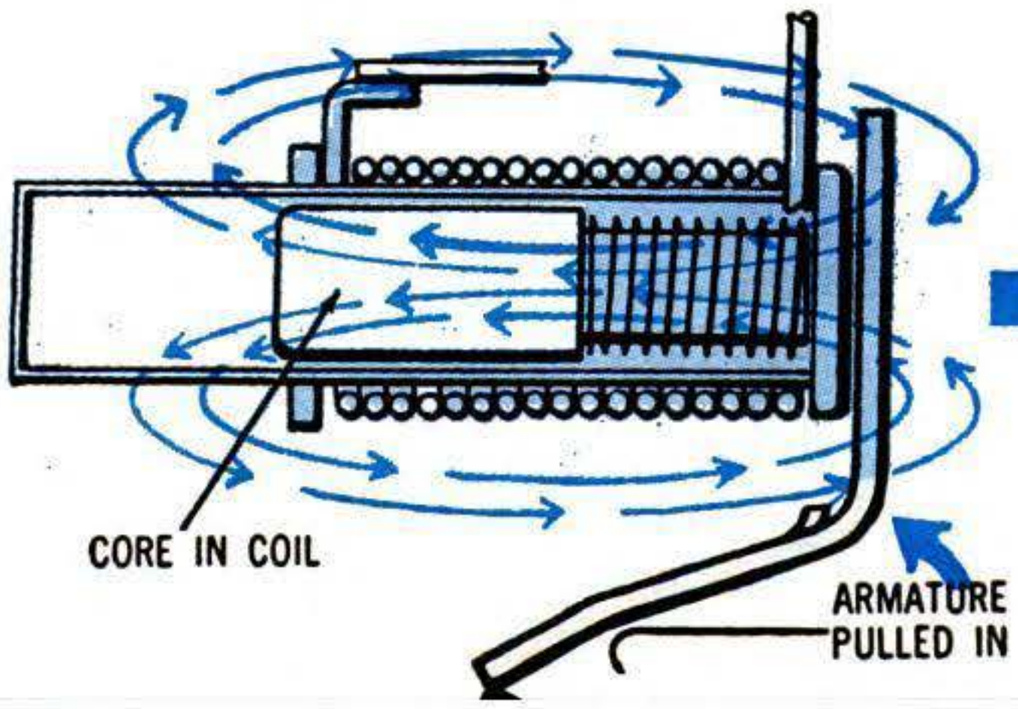
2. EXCESSIVE CURRENT, as when a motor starts, boosts the field, draws core in. But the spring and fluid slow it. As motor revs up, its current draw lessens, and the spring pushes the core back.

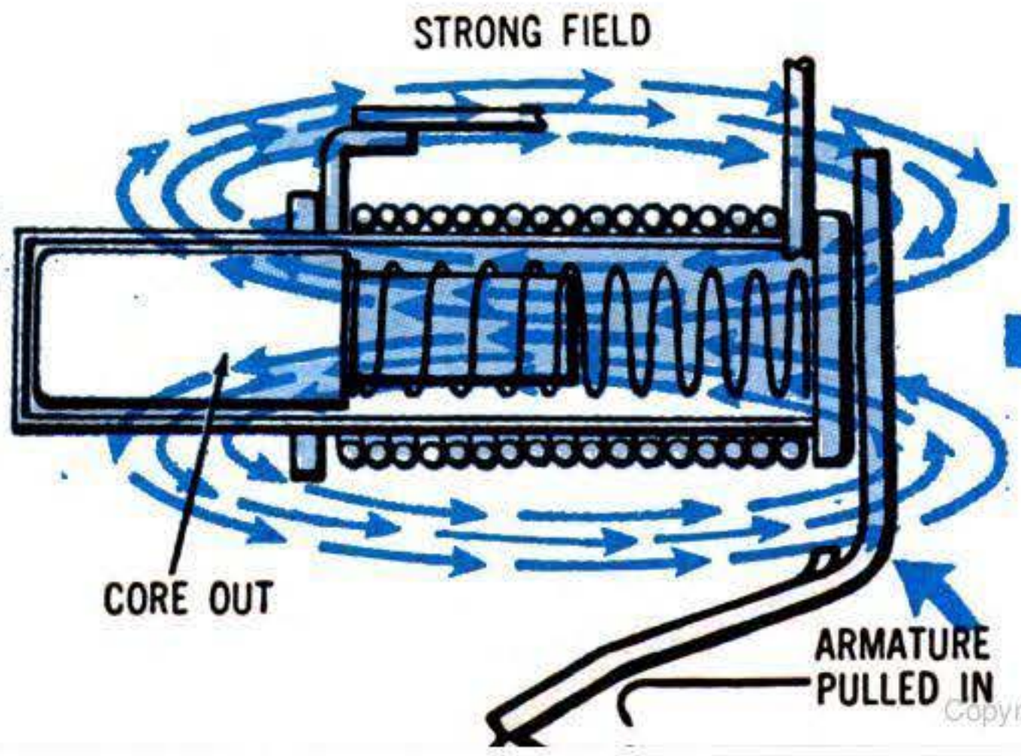


3. IF OVERLOAD CONTINUES, as when a motor tackles too big a job, or if current is heavy enough to pull core in fast despite hydraulic delay, core's presence at coil end intensifies the magnetic field, attracting the armature.



4. ON SHORT CIRCUITS, high current in coil creates a field so strong it yanks armature in before core can budge. Armature levers on the roller unlatch, letting the spring contact snap open and the reset cam flip back.





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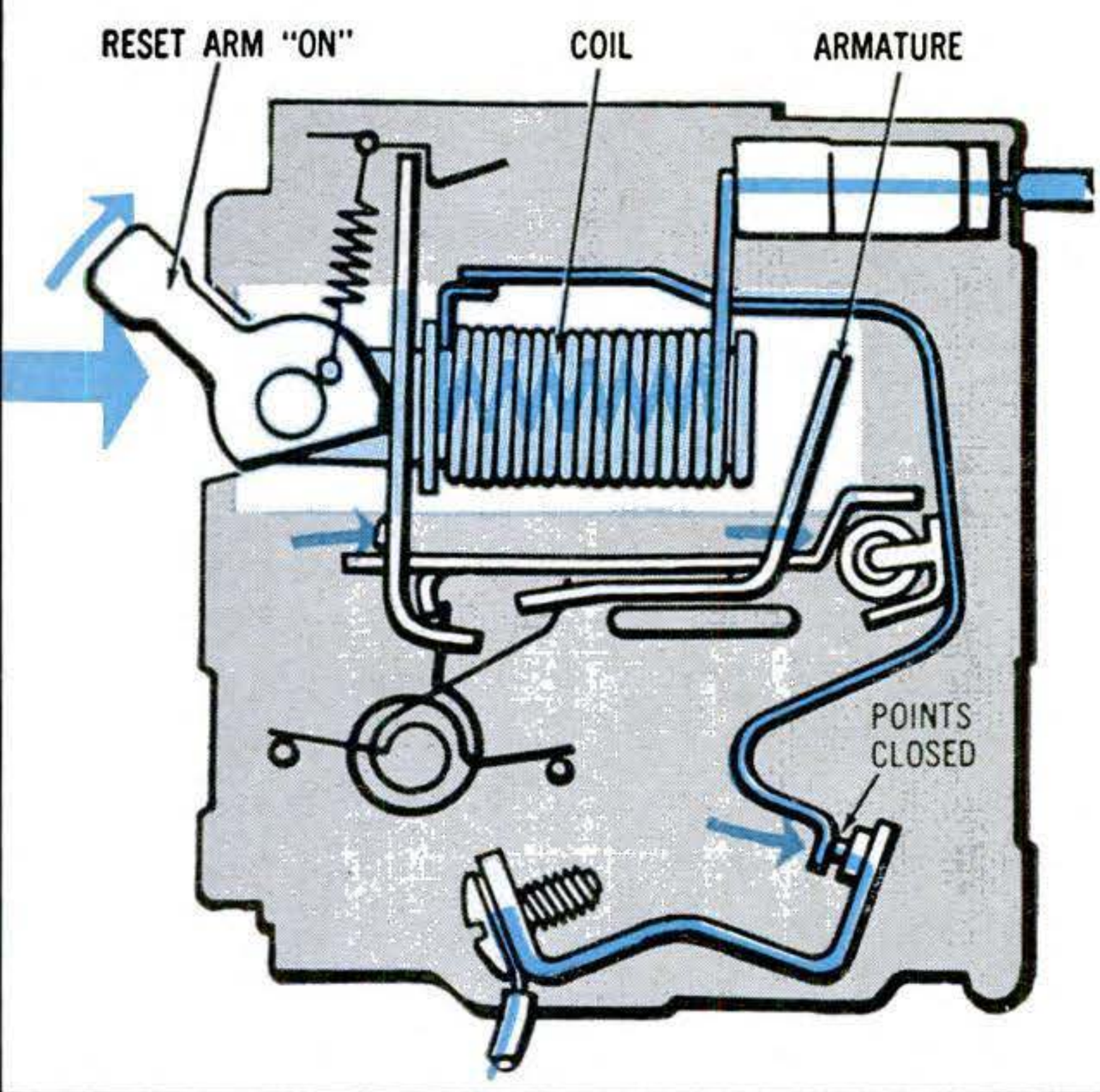
Breakers Work

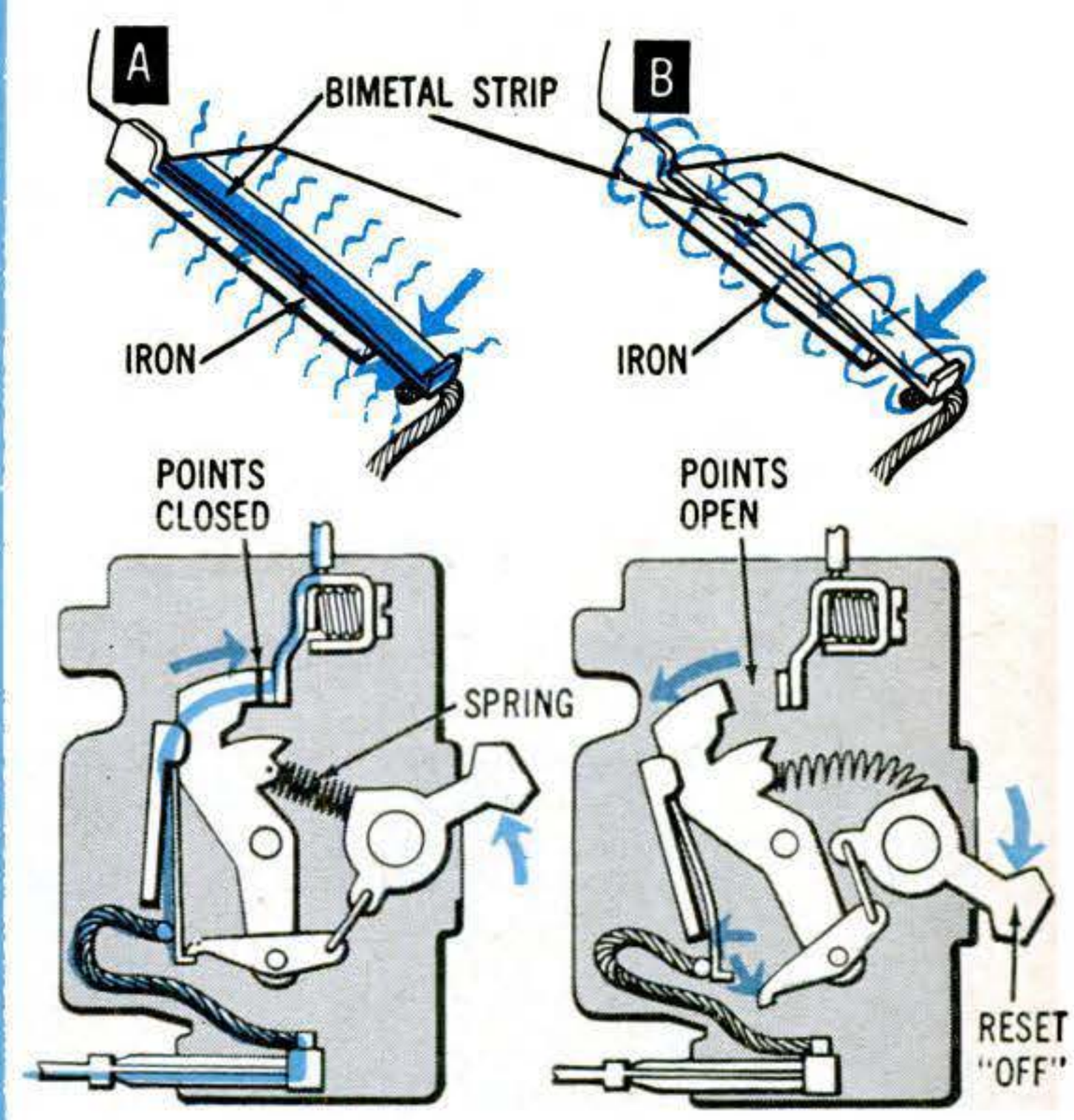
ing effect of the current to trip them. Two strips of dissimilar metal fastened together, called a bimetallic element, warped when heated by the passage of excessive current, tripping spring-loaded contacts.

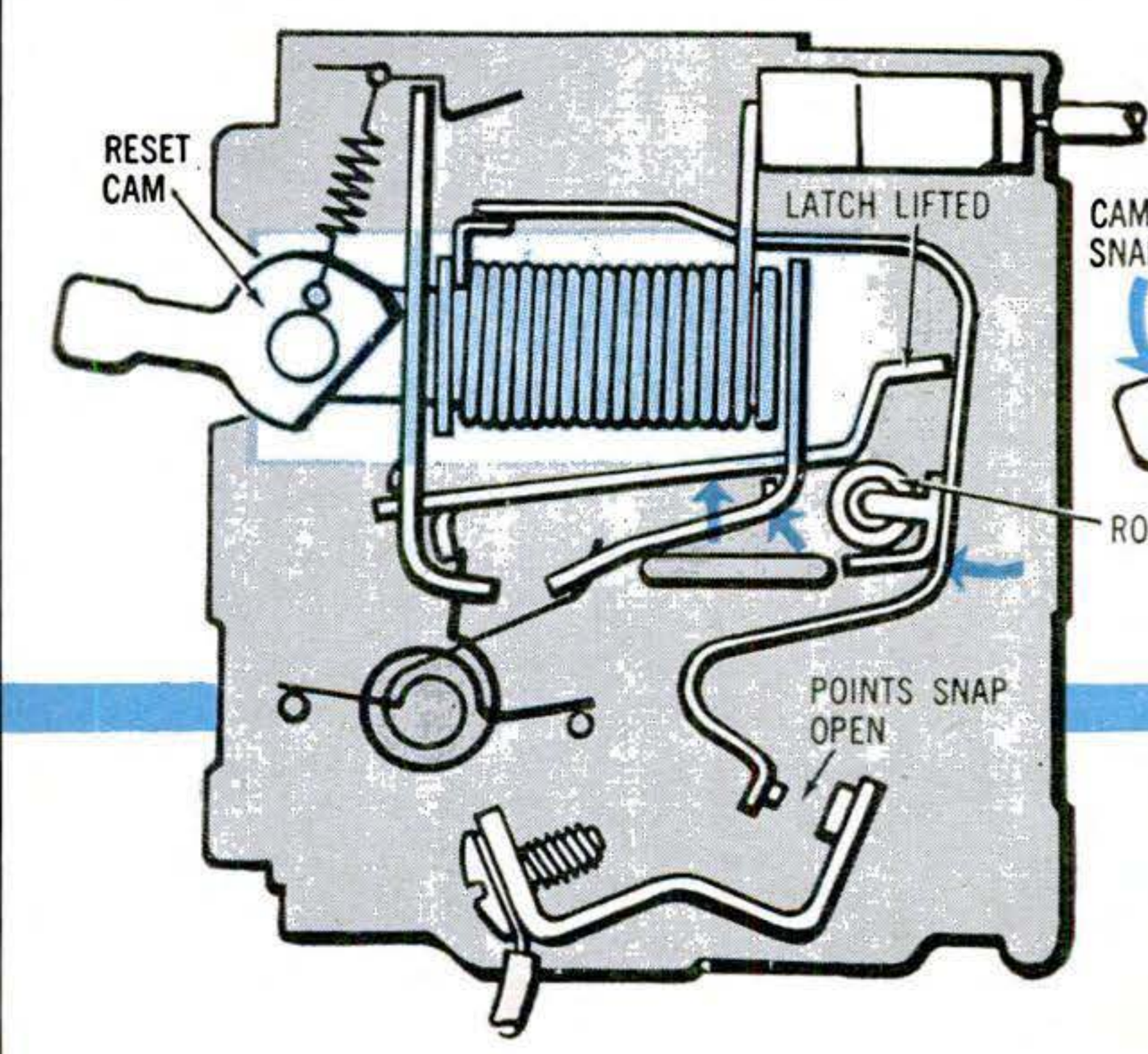
Modern breakers combine thermal and magnetic action, or use a magnetic coil with a hydraulically delayed plunger or core. They are designed to hold under temporary overloads, open the circuit if an overload continues, and break in less than a hundredth of a second in case of a short circuit.

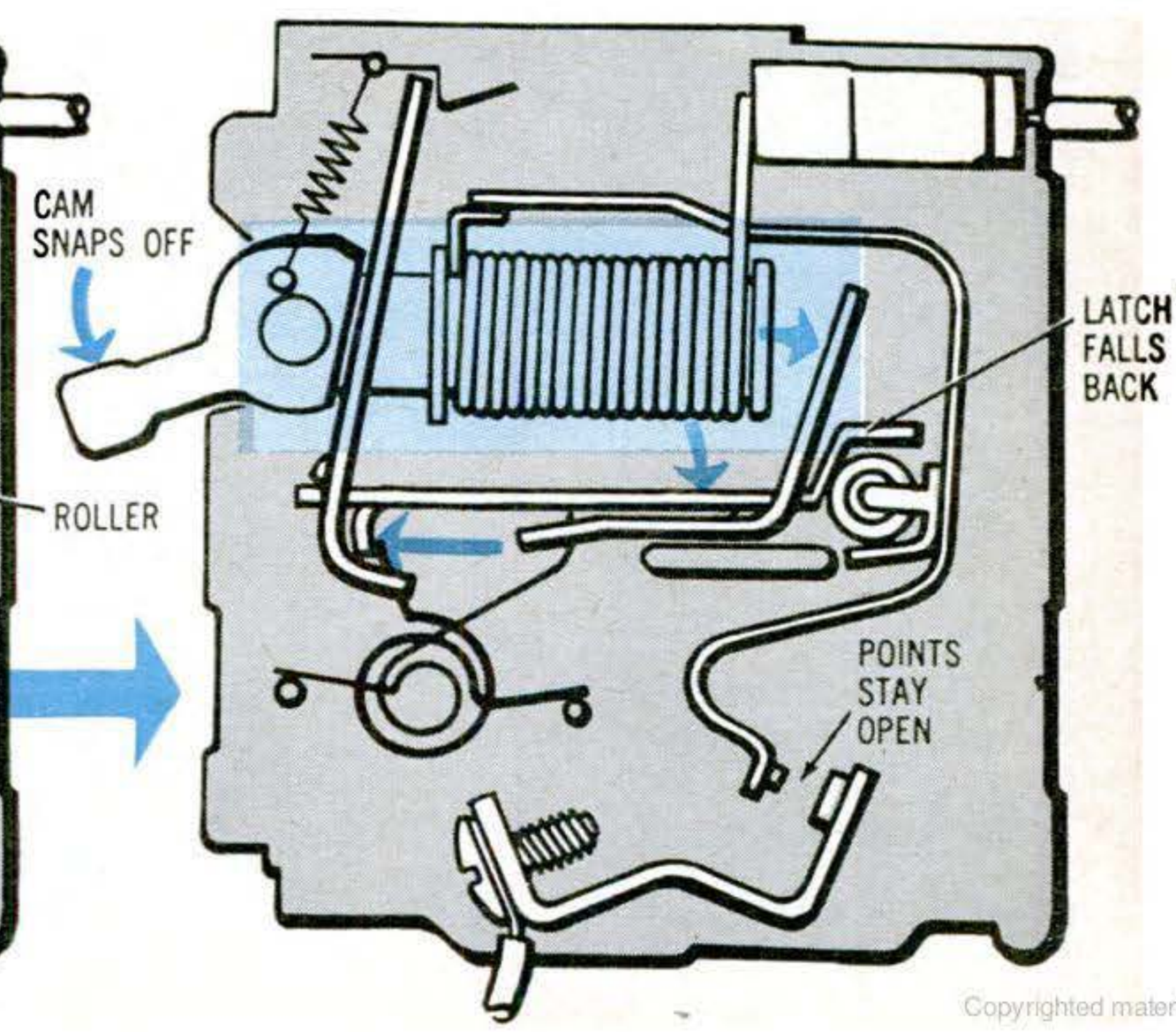


Thermal-magnetic breakers respond to two forces

FASTENED BESIDE THE BIMETAL STRIP in these circuit breakers is a piece of iron. Ordinary overloads, after a brief delay (enough to let a motor attain speed) heat the bimetal element (A). Bending, it frees toggle latch; the contacts snap open. On big overloads or short circuits, the high current in the strip surrounds it with a strong magnetic field (B). Attracted to the iron piece, it bends as if heated, but does so instantly. The contacts therefore snap open with no time delay at all.







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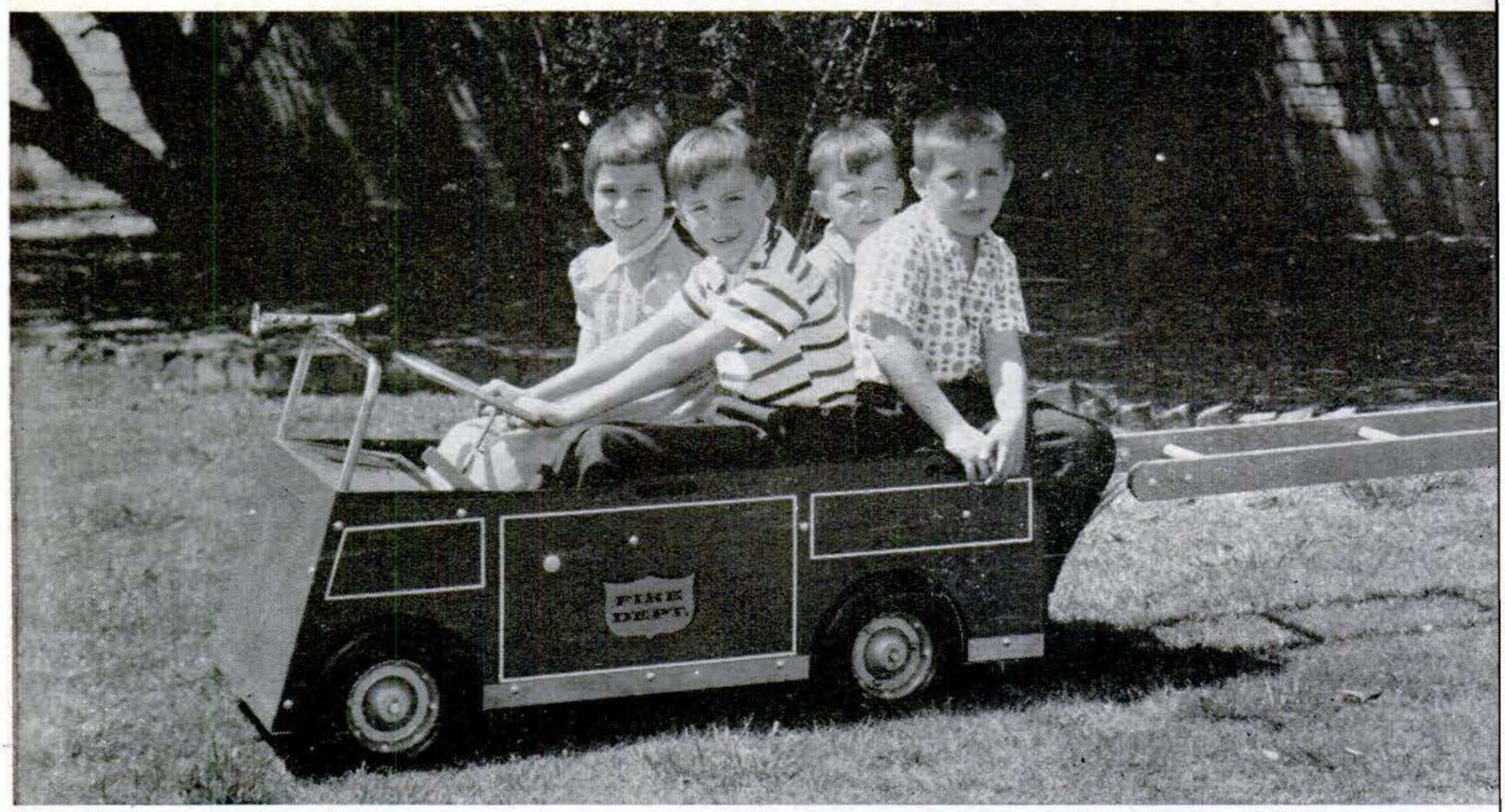
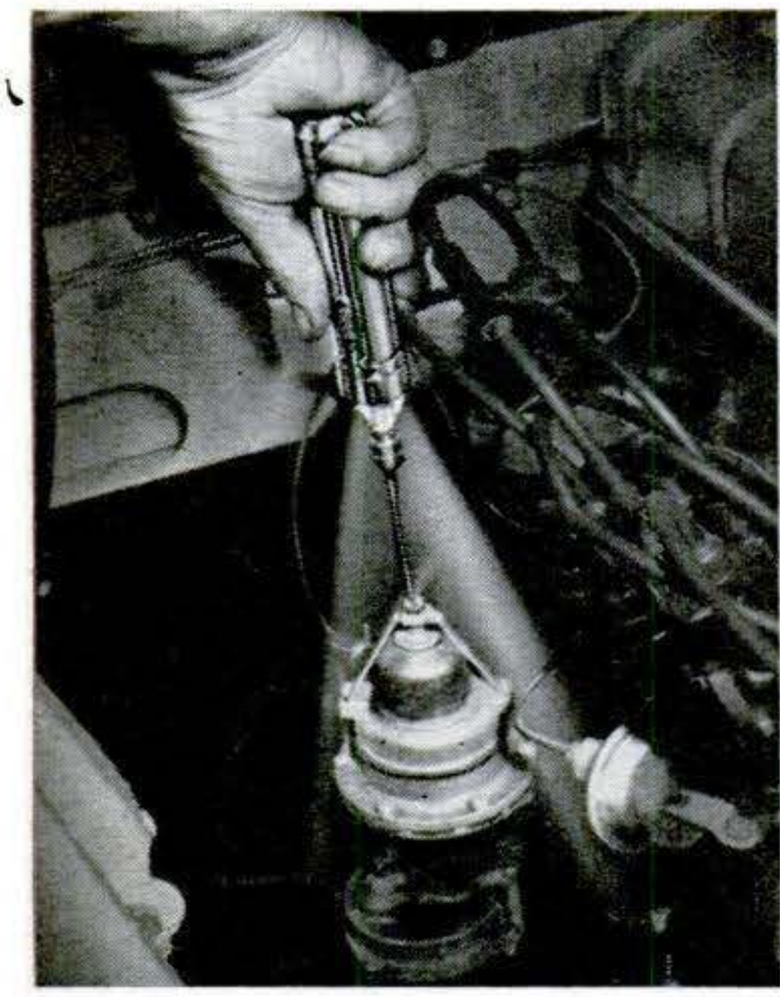


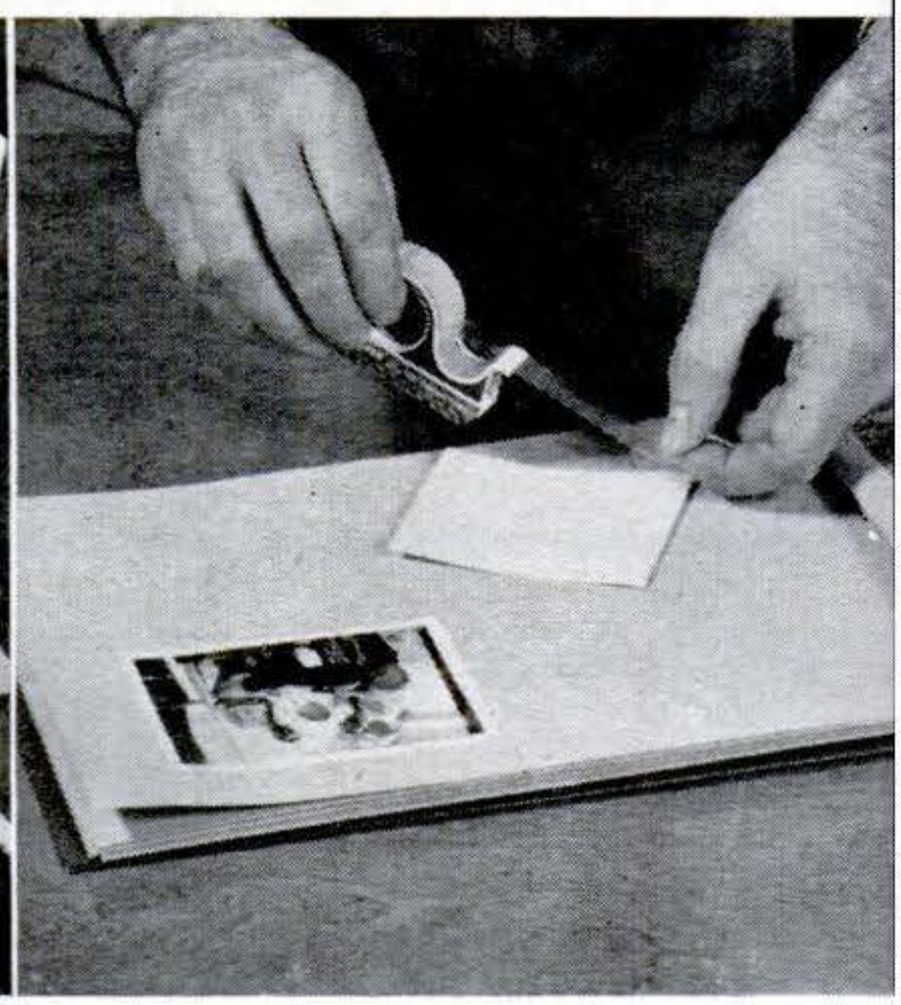
Batteries Run Child's Fire Engine

Here's a junior hook-and-ladder that runs all day on its own juice. It has two six-volt rechargeable batteries and a built-in charger that plugs into house current overnight for a new lift. It's eight feet long from radiator to tiller-



SCREWDRIVER set in plastic flashlight lens puts light where you need it when working in dark corners. It has interchangeable blades—two regular and two Phillips. Handle holds standard batteries. $2.95. Truline Sales Co., Box 1158, Studio City, Calif.

PLASTIC CLEANER gets rid of grease, dirt, and weather stains on fiberglass boats, from windshield to keel, without scratching. You simply wipe it on with a cloth and wipe it off. Pint, $1; gallon, $5.90. Permatex Co., 300 Broadway, Huntington Station, N. Y.



TWO-FACED TAPE has a different kind of adhesive on each side. They won't stick to each other in the roll, but stick to almost anything else. The new Scotch cellophane tape sells for 39 cents. Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul, Minn.

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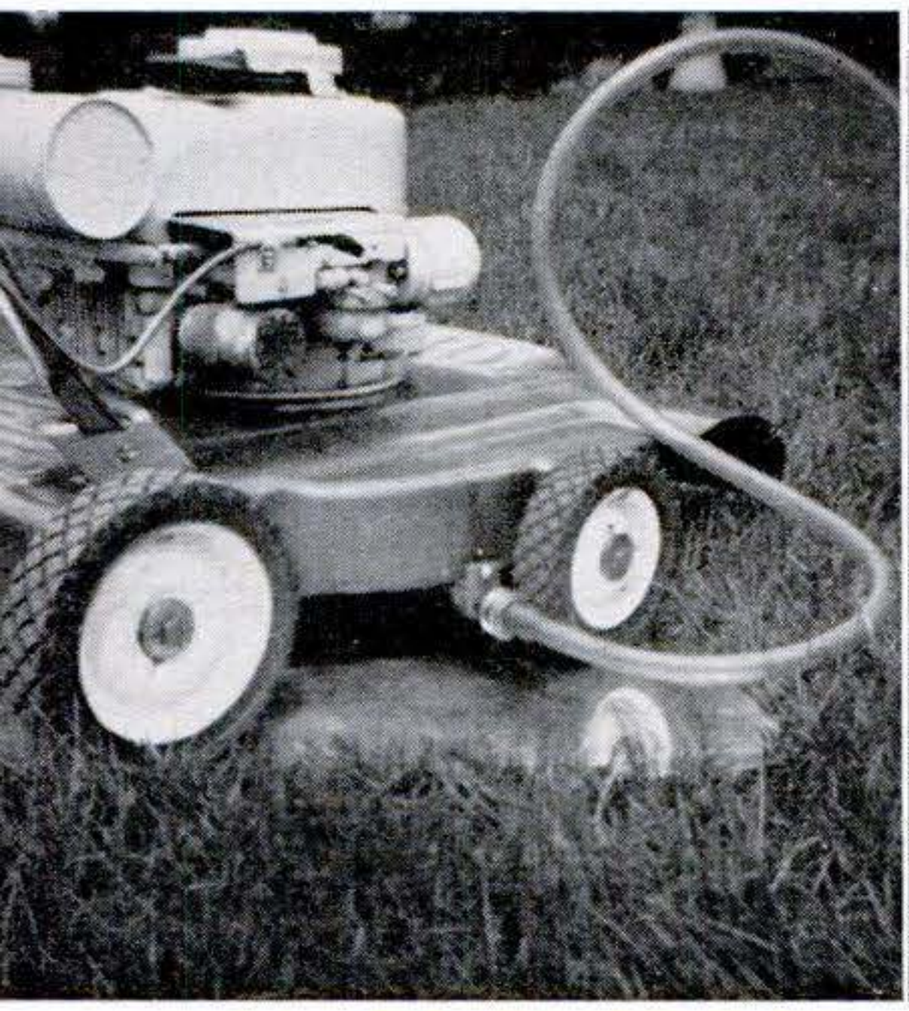
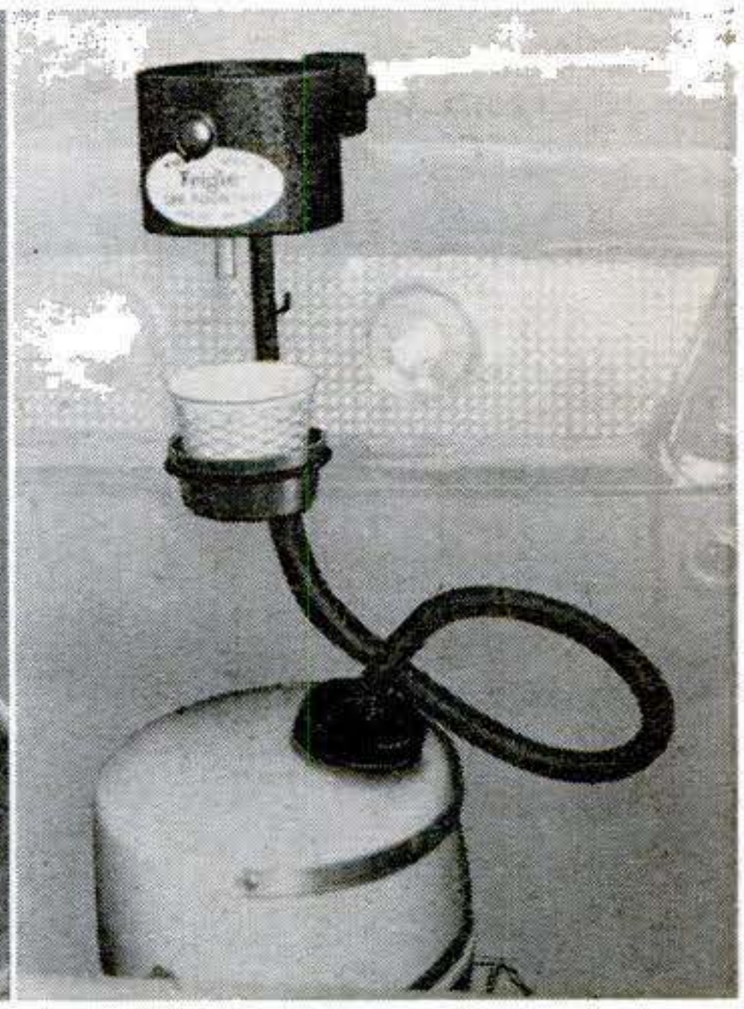
man's seat, has five-m.p.h. forward and reverse speed, and, like dad's car, needs an ignition key to start it. Price, including freight, $425. Donnan Mfg. Co., 1335 Airway, Glendale, Calif.

ELECTRIC FISH SCALER works on a car battery through the cigarette lighter. You can use it also on 110-volt AC by removing the head and flexible shaft from the motor and chucking them in an electric drill. Six or 12 volts, $19.95. Dremel Mfg. Co., Racine, Wis.



MOWER CLEANER is a right-angle nozzle that couples to the end of a hose and clamps to the skirt of any rotary mower. Turn on water and power, and the swirl washes off cuttings in a few minutes. $1.98. Garbark Engineering, 700 Manchester, Westchester, Ill.

ANGLE PRUNER has its shearing head at 45 degrees from the handles so you can hold its blades on a branch without twisting your wrist. It has cushion grips and a thumb-flick safety lock. "Rocket" pruner is $3.25. True Temper Corp., 1623 Euclid, Cleveland.



CAR FOUNTAIN lets you draw hot or cold drinks while driving. It fits on the dash, works on the car vacuum to pump liquid from a picnic jug or vacuum bottle on the floor. $10.95; for rear-engine, $11.95. Frigie Car Fountain, 1301 S. 20th Ave., Yakima, Wash.

CONTINUED

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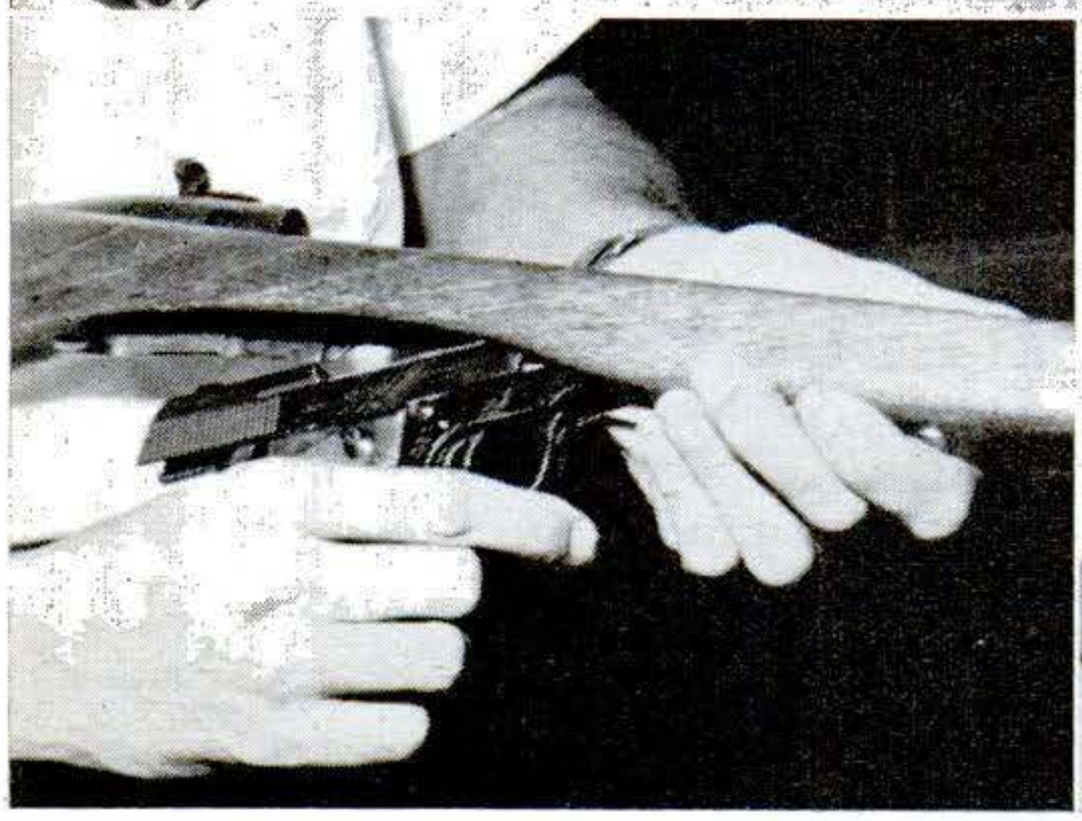
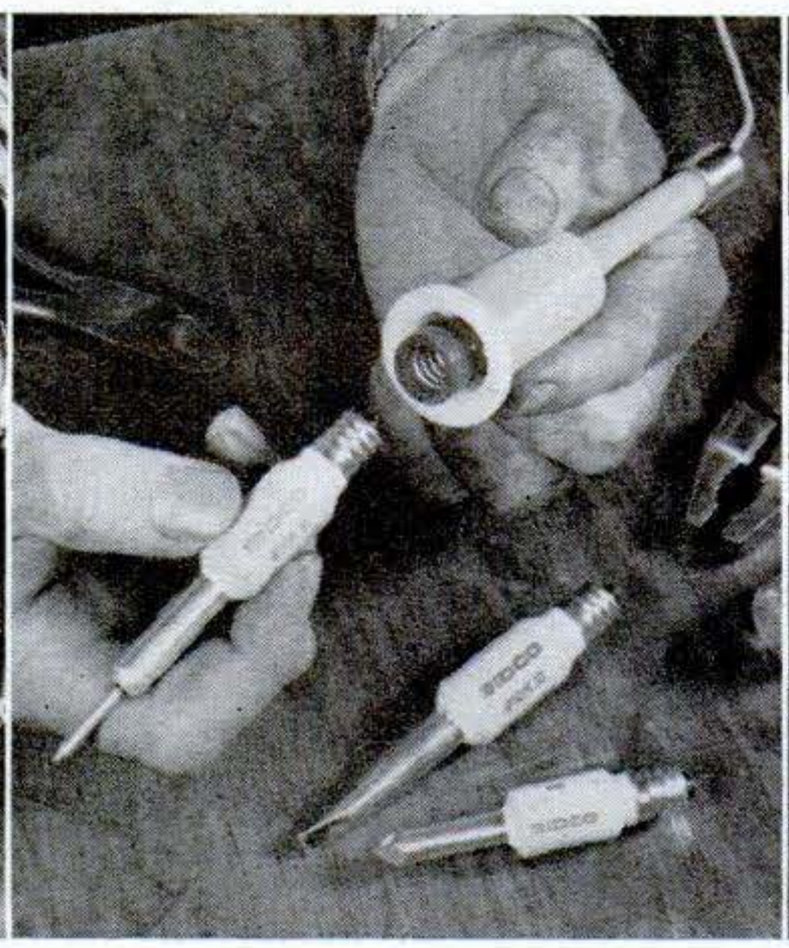
Pistol to Rifle in 10 Seconds

The action of this .22-cal. combination gun serves both pistol and rifle versions. Remove the pistol barrel and fit the mechanism into the rifle unit, and in 10 seconds you're ready to fire. To change back, reverse the process. No tools are needed. The Combo complete sells for $64.95. Firearms International Corp., 4837 Kerby Hill Rd., Washington, D. C.



SEAT COOLER creates a breeze where you need it most in sticky weather. A shrouded fan plugged into the cigarette lighter blows air into the cushion and backrest. It works on both 6 and 12 volts. Price, $29.75. Hupp Corp., 1135 Ivanhoe Rd., Cleveland.



AIR-COOLED IRON has a vented space surrounding its heating element to keep the nylon handle from getting too hot to hold. It is made to take a variety of interchangeable tips from 25 to 50 watts. Handle, $2.50; tips, $1.25 up. SIDCO, Venice, Calif.

SNAP-OFF BAGS come in rolls. Just pull out the tubular polyethylene to a sealed, perforated line and tear off on the serrated edge of the box. Two sizes: 20 bags 10 by 14 inches, 40 bags 6½ by 8. With ties, 49 cents. Lion Packaging Products Co., Hicksville, N. Y.

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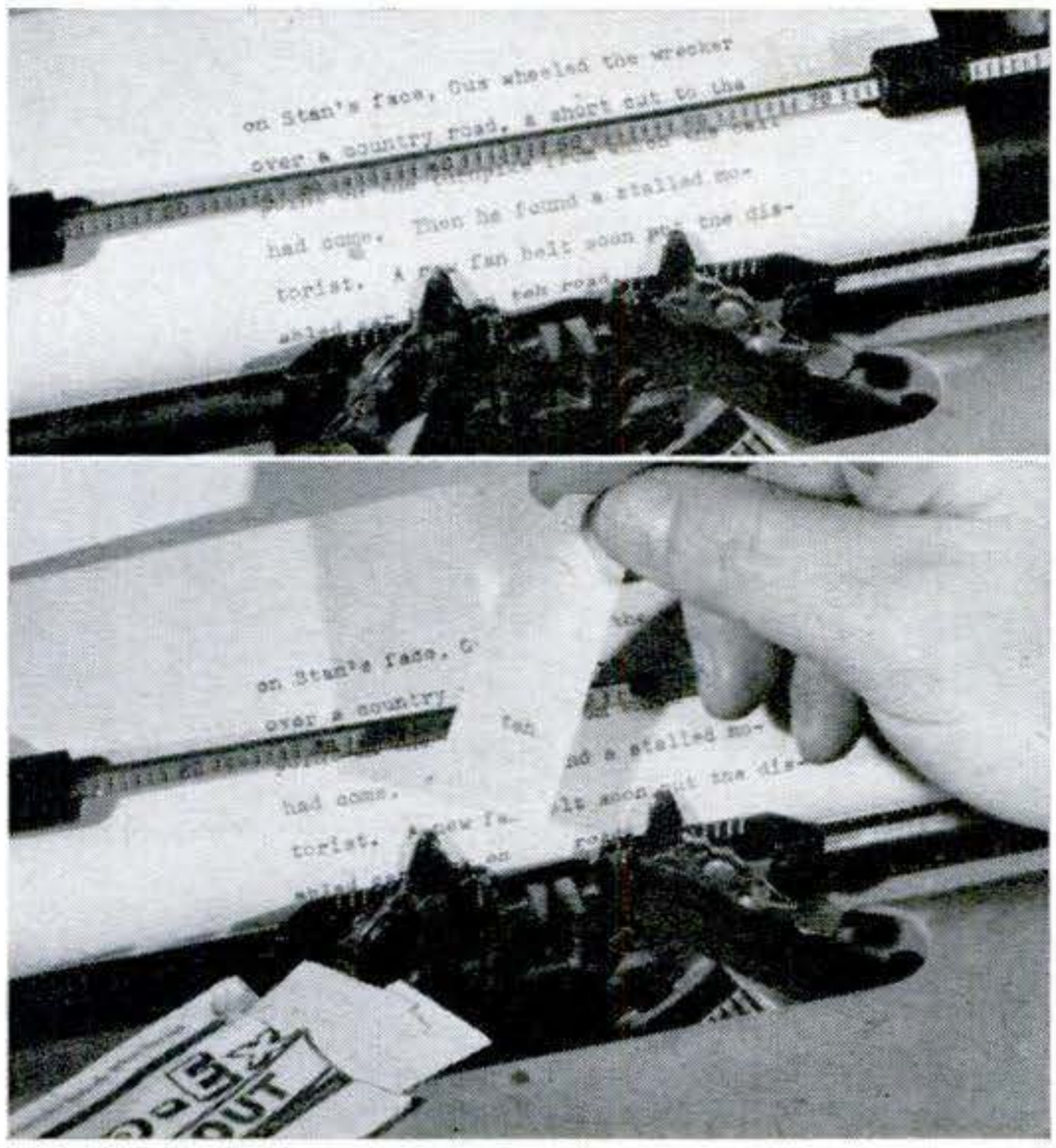
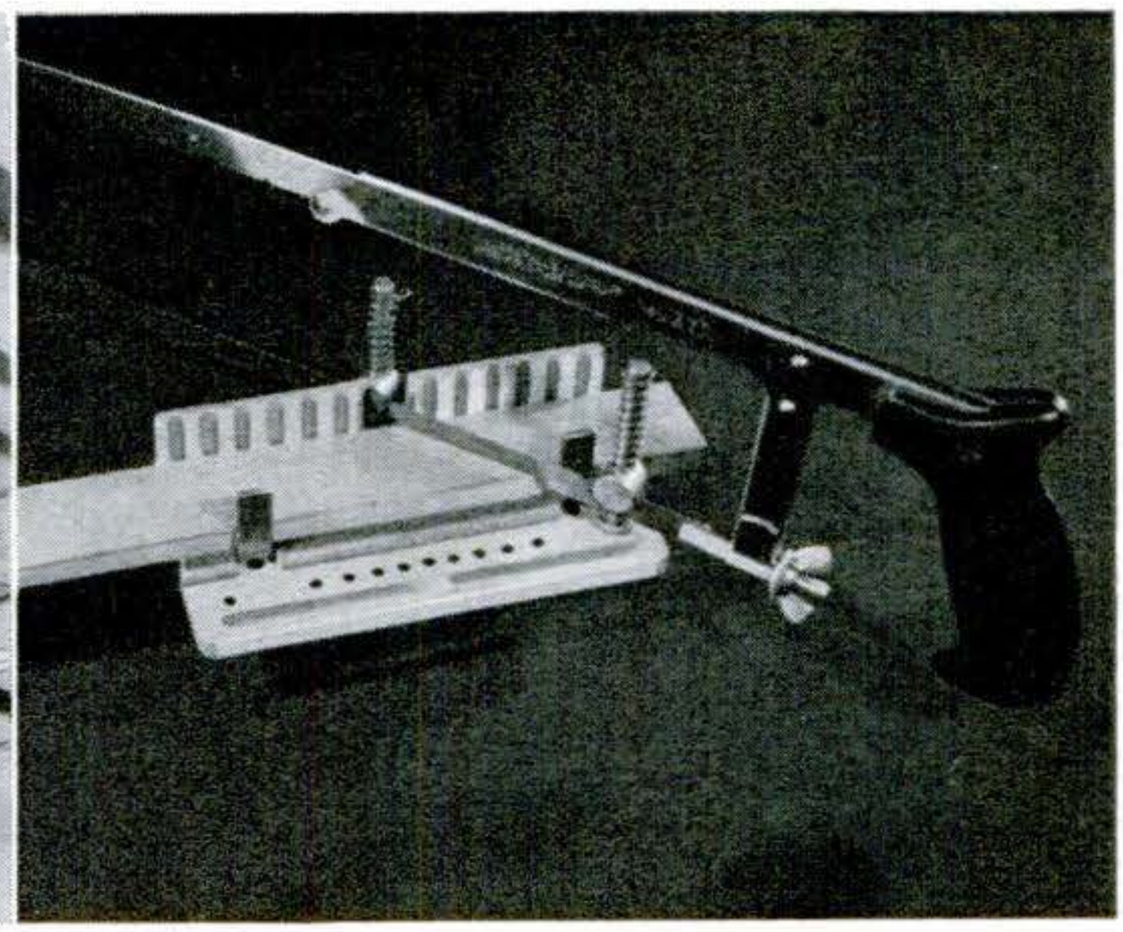


TYPEWRITER ERASER is chemically treated paper. You place it over an error, retype the incorrect letters on it. This leaves the space clean for the right characters. Each sheet can be used about 30 times. Another is made for carbons. Package of 12 of either, 39 cents. Type-Out Corp., 850 Seventh Ave., NYC.

CERAMIC FELT lines the firebox of an oil burner to improve combustion. It's a flexible blanket of mineral fibers that cuts formation of soot and frequency of periodic cleaning. You can install it yourself, but the burner must be adjusted. Kit sells for about $15. Johns-Manville Corp., 22 E. 40th St., NYC.

CARPET ANTENNA is a flat, flexible printed circuit for TV and FM that you can staple to the attic floor or joists, or almost anywhere in the house. You can get with it a complete system including wiring, TV and FM amplifier, and several plug-in outlets. You can buy the antenna alone for $9.95; the whole system for $77.70. Jerrold Electronics Corp., 15th and Lehigh, Philadelphia.



ADJUSTABLE MITER BOX takes a standard hacksaw and cuts at various angles. A pin on one of its blade guideposts fits holes set for zero, 7½, 15, 22½, 30, and 45 degrees. The cast-aluminum box handles wood, metal, and plastic stock up to 1¾ by two inches. You can clamp it in a vise or fasten it to the bench. $5.95. Riverside Enterprises, 7 S. Buffalo St., Corning, N. Y.

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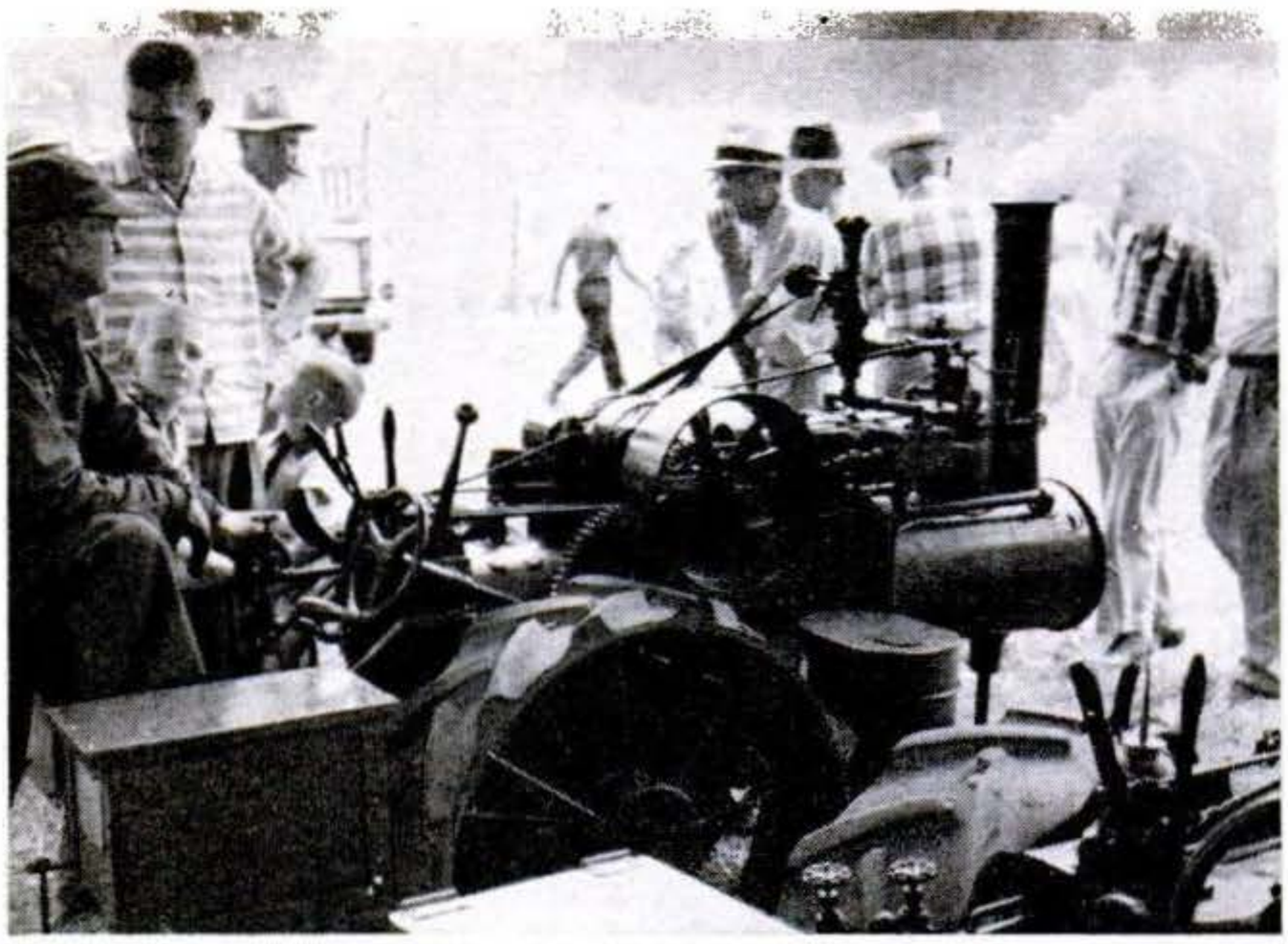


NO ANTIQUE, this authentic-looking small-scale model was built with spare parts. It develops two horsepower.

Old Steam Tractors Never Die

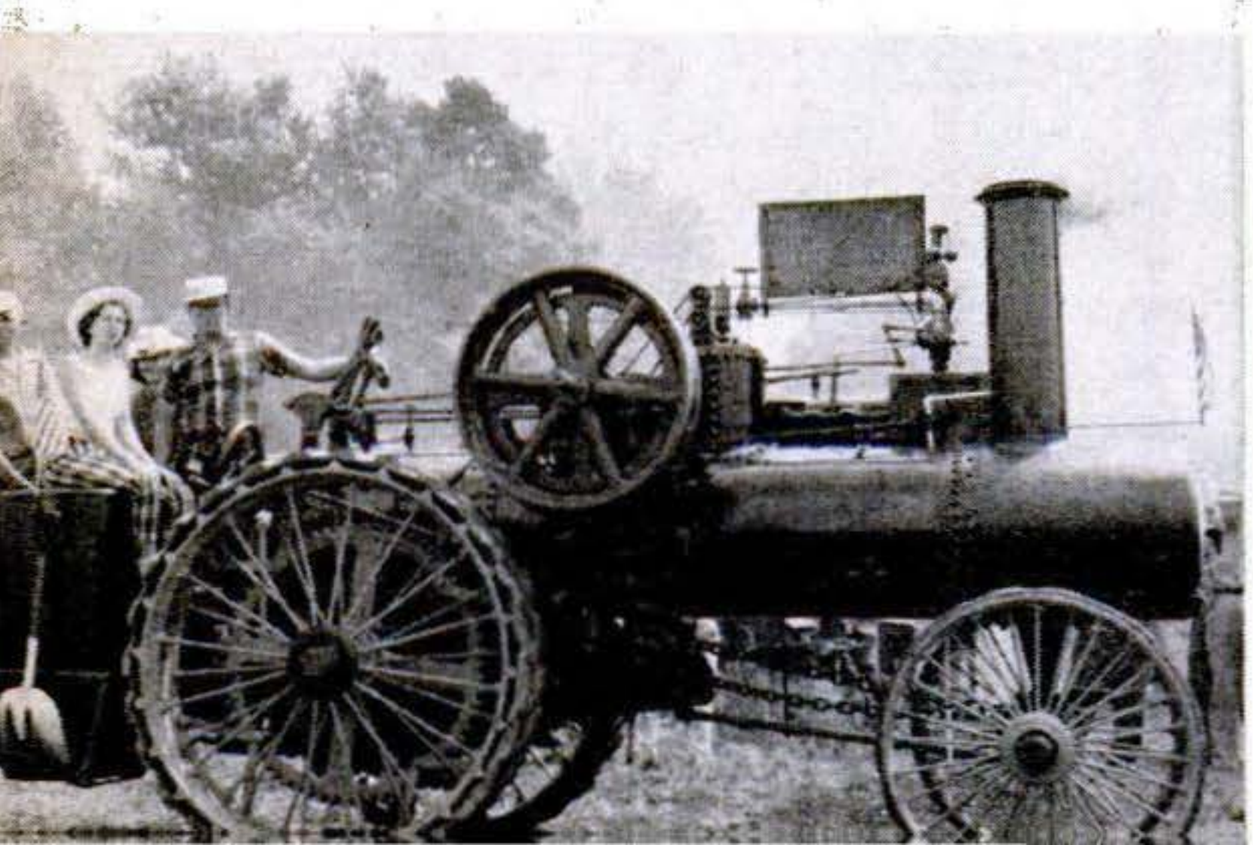
. . . they just chuff away

A SWARM of steam engines, belching smoke and tooting full-blast, has converged on Rushville, Ind., each August for the past 12 years.

The occasion? The annual reunion of the Pioneer Engineer's Club of Indiana, which draws dozens of entries, some as much as 75 years old. Many are perfect restorations, while others, still used daily, are modified with automotive parts. A few are newly built specials and scale replicas.

All have one thing in common: They run.

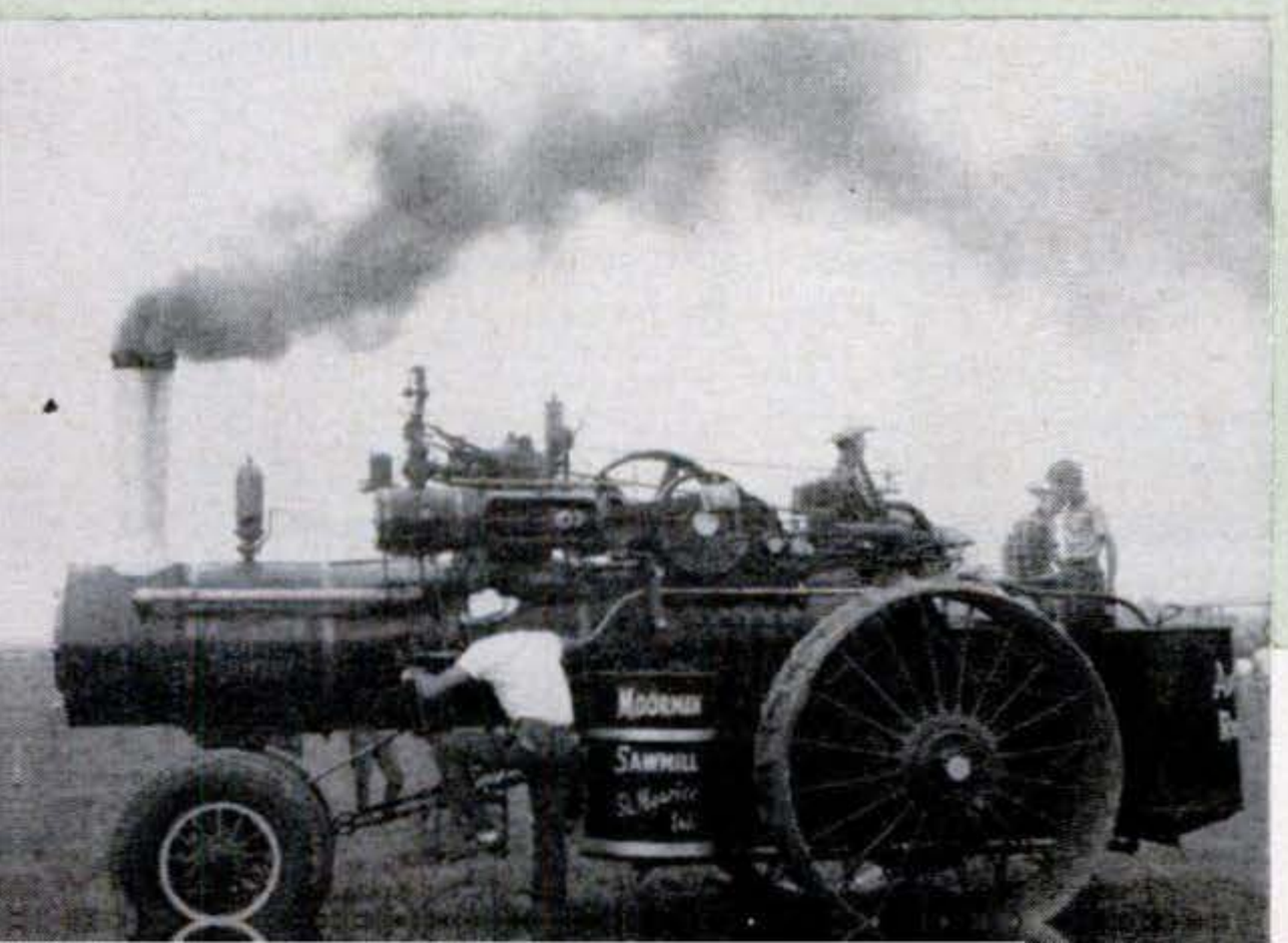
THRESHING AND SAWING were once the tasks of steam engines like this 12-hp. 1906 Russell.



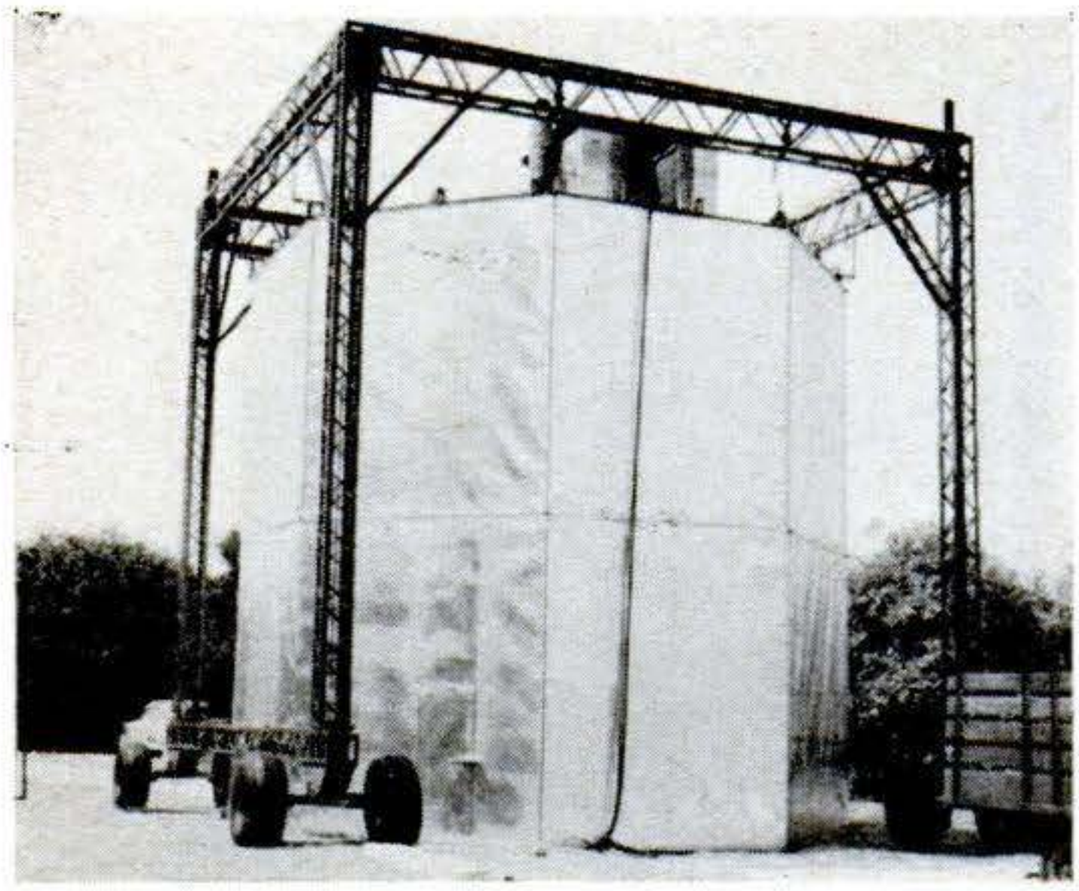
MODEL A FORD CHASSIS plus an assortment of other early-auto parts make up this special.

Steamers of all shapes and sizes line up and prepare to loose a deafening chorus of whistles.

SINGLE-CYLINDER 1920 Advance Rumley engine, boasting 20 hp., can still saw wood today.

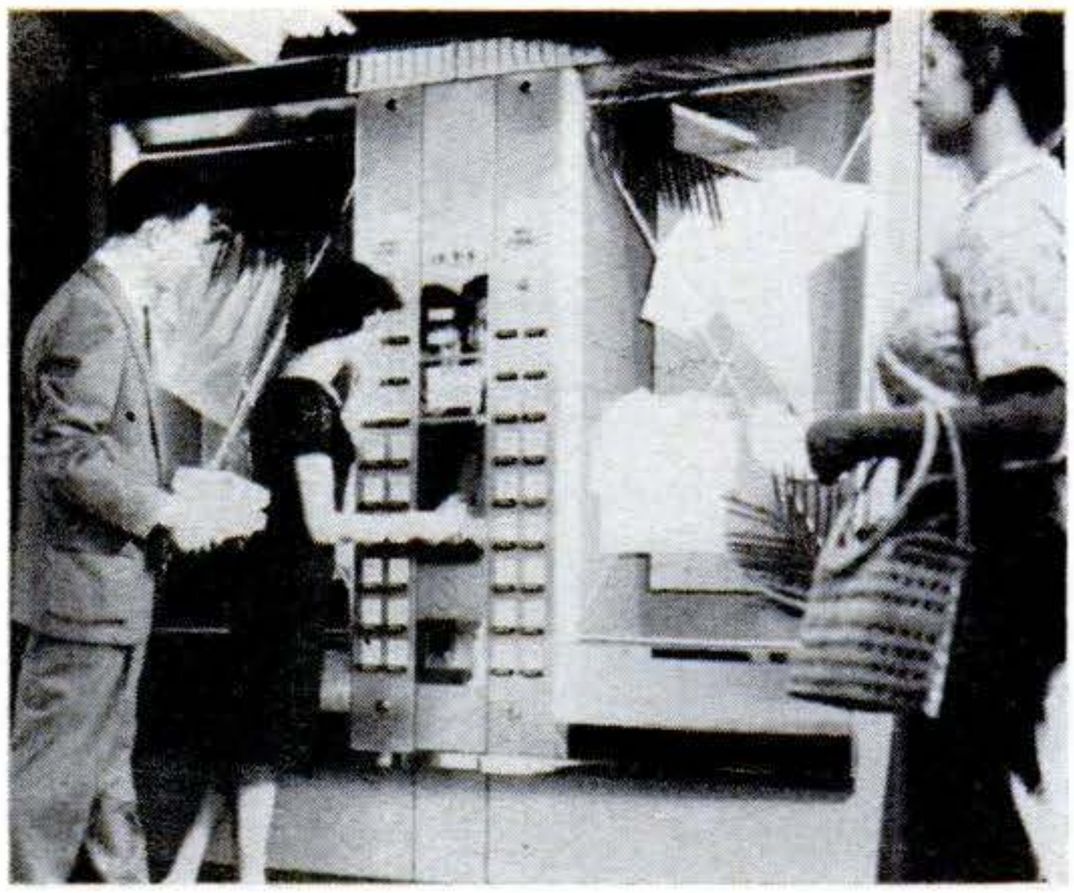


SPORTING CADILLAC WHEELS, this 1907 Case gives Greenburg, Ind., children Sunday rides.



It chills trees

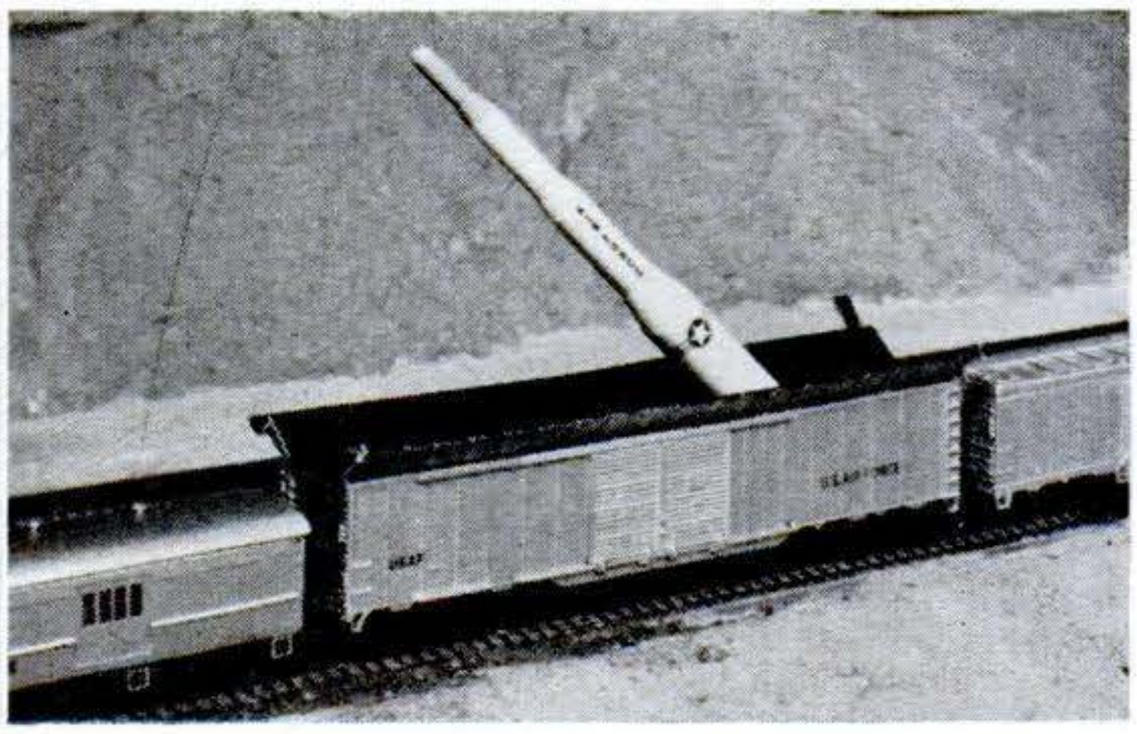
This huge freezer, large enough to accommodate a full-grown orange tree, will allow the Florida Citrus Commission to make controlled studies of the effects of cold weather on citrus crops. Temperature and humidity are precisely controlled by a 15-ton refrigerator unit on top of the chamber. Insulated side panels open like a garage door so the freezer can be towed from tree to tree.



Pushbutton salesman

A new kind of vending machine now dispenses shorts and undershirts to department-store customers. It takes currency, makes change, and gives you your right size—assuming you push the right button. Merchandise is on display in showcases at either side. The machines are made by Universal Match Corp., and one of them is getting a trial run at Macy's in New York.

BIRD IN ITS NEST, the solid-fuel Minuteman is lowered here into a single-hole silo at Edwards Air Force Base in California. Eight tethered shots were fired, all successful.



MODEL MINUTEMAN is shown above being raised into blast-off position in an HO-gauge railroad car built to an early concept. Actual launching car is now under construction.

Minuteman gets set

America's newest ICBM, the solid-propellant Minuteman, is being lowered here into an underground silo in preparation for a tethered flying test. The Minuteman is a three-stage missile assembled and tested for the Air Force by Boeing. It is designed for firing from either a single-hole silo [PS, March] or a mobile launcher [PS, Aug. '59]. The first of a series of missile-train test runs has been made over tracks of the Union Pacific, Western Pacific, and Denver & Rio Grande railroads in the West.

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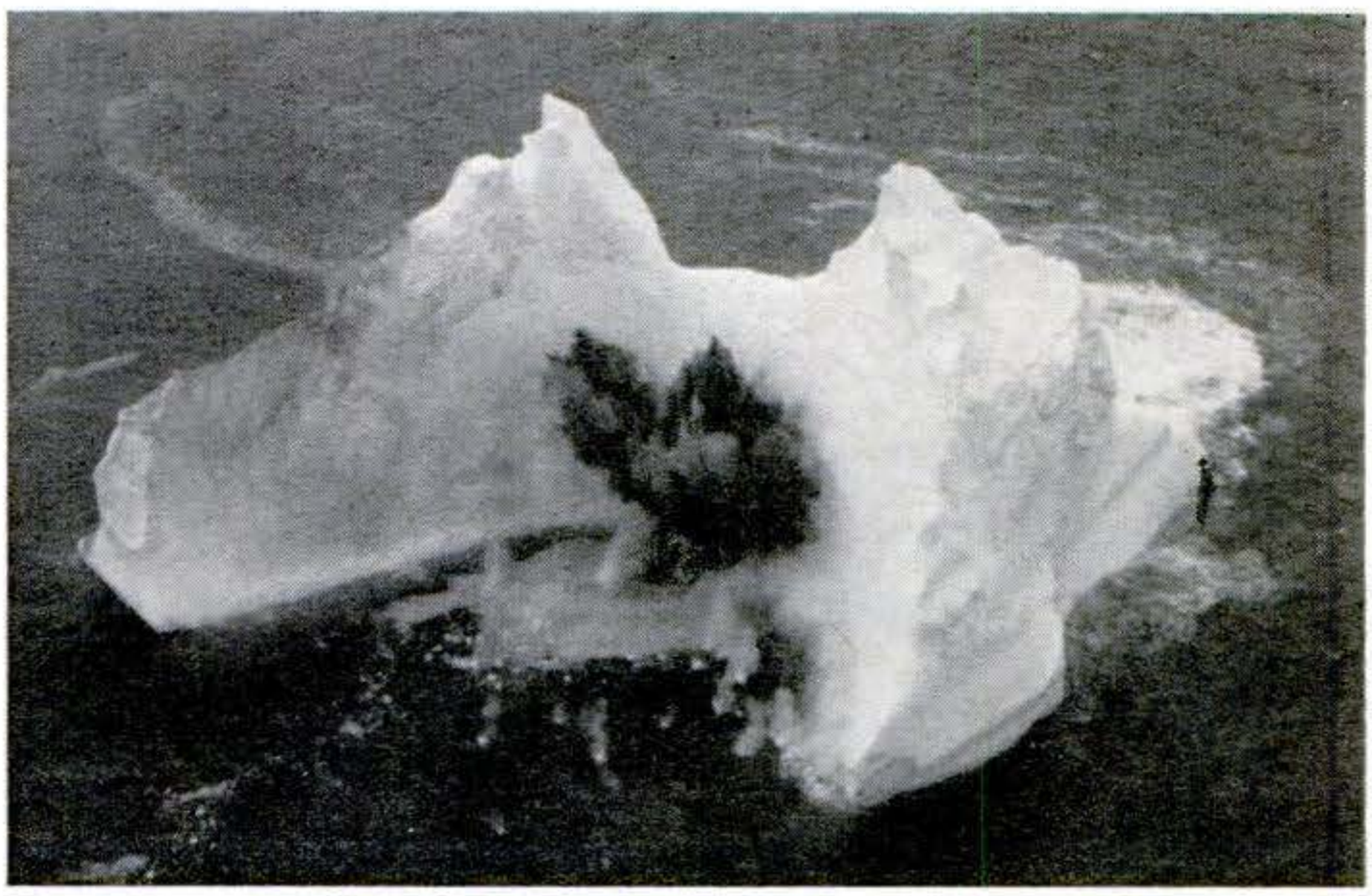
TARGET IN BOMBSIGHT, one of the explosive eggs is dropped.



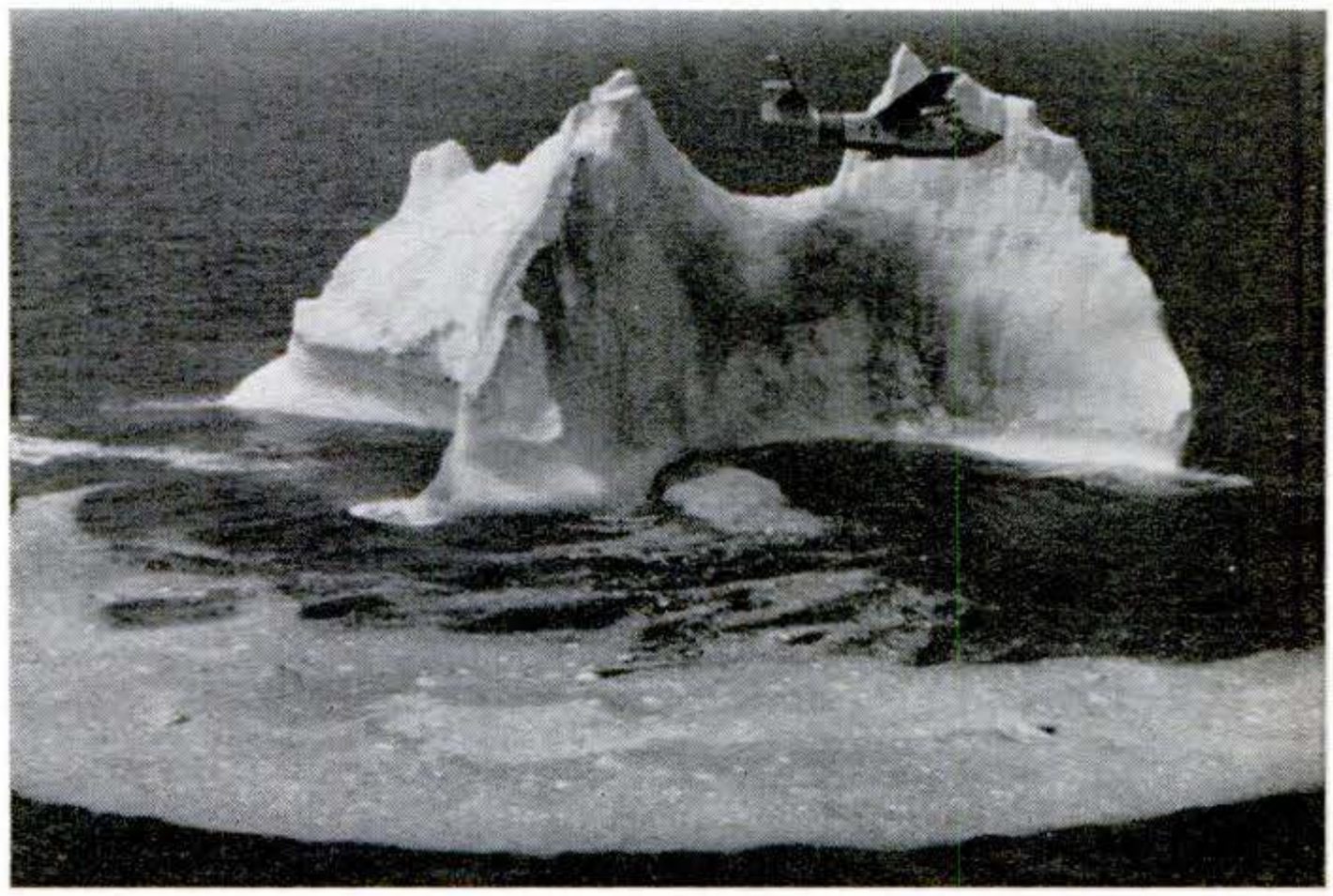
DIRECT HIT is scored on big berg by 1,000-pound bomb. The plane made 10 runs at 800 feet, carried two bombs on each.

Icebergs make tough targets

The U.S. Coast Guard is testing the effectiveness of bombing to break icebergs up before they float into shipping lanes.

The big fellow shown here in international waters 160 miles off Newfoundland was this summer's target. It's 150 feet high, 300 feet wide, and weighs about 1,000,000 tons.

The plane dropped 20 conventional 1,000-pound bombs in a period of a week, scored 16 direct hits, didn't succeed in breaking it up.



DAMAGE IS SURVEYED by bombing plane after one hit. Scattered bits of ice chipped by explosion float in the water.

Hands on his harness buckles . . .

. . . Army paratrooper lets canopy fly.

Parachute release—pronto

A new quick-release device now lets the Army's paratroopers get rid of their billowing parachute canopies as soon as they hit the ground. It's worked by three-step shoulder locks that can't open accidentally in the air. When a GI lands, he flips two covering clips, presses a button on each, and pulls open the locks, allowing the canopy to fly free. No longer does he have to get to his feet, rush around to the canopy, and try to collapse it while exposed to enemy fire.

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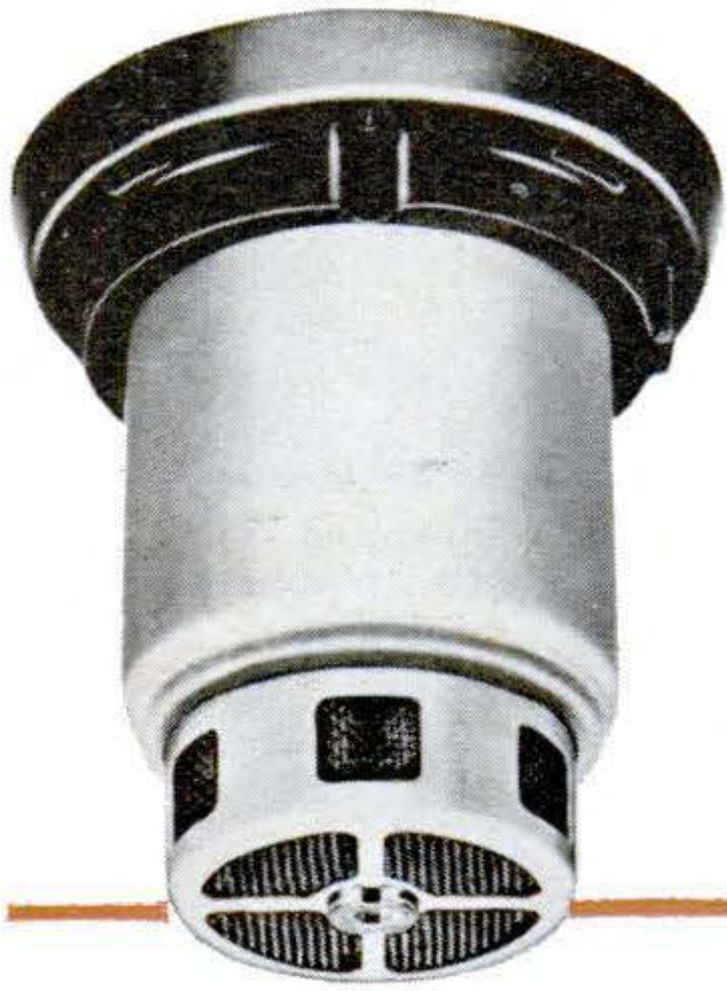
New Alarm Detects Fire Before It Starts



Early warning often makes the difference between life and death. This nuclear device might prevent such tragedies as Chicago's LaSalle Hotel blaze where 61 died

By Paul W. Kearney

AT A children's convalescent home in Chappaqua, N. Y., the overheat device on an oil burner failed to function and the boiler became dangerously hot. Neither flame nor smoke were present, but a "nuclear fire detector" in an *adjoining* room was triggered by invisible combustion products. In the boiler room itself, a conventional fire detector had never gone into operation.

At a South Portland, Me., factory the insulation on a motor winding began to smolder. A nuclear alarm summoned the fire department by direct connection, and the motor was turned off before trouble began.

These are just two of the many instances in which fire was prevented because a supersensitive nuclear detector provided early warning. How does this revolutionary device report fires before they actually start, while conventional detectors sound an alarm only during the later stages?

Most fire detectors are thermal devices. Rising heat activates a thermostatic or pneumatic control and sets off the system. Smoke detectors, on the other hand, are generally electronic eyes whose invisible beams, when broken by a column of smoke, turn in an alarm. The important thing to remember is that in either of these conditions a fire is already under way.

This one is different. The nuclear detector, called Pyr-a-Larm (and made by Pyrotronics, Newark, N. J.), utilizes the fact that air is made conductive by alpha particles emitted by a minute source of radium. The air molecules are ionized into positive ions and negative electrons; when voltage is applied across an ionization chamber a small electrical current is formed. Products of combustion entering this chamber also become ionized, but because of their relatively large size they move more slowly, thereby reducing current flow.

The current is so small that it must be amplified to complete an alarm circuit. This is done with a specially designed cold-cathode tube connected in parallel with two ionization chambers. The tube contains no filament, and an anode current passes only during alarm.

As the outer chamber is open to the air and the inner chamber virtually sealed, any reduction of current in the outer

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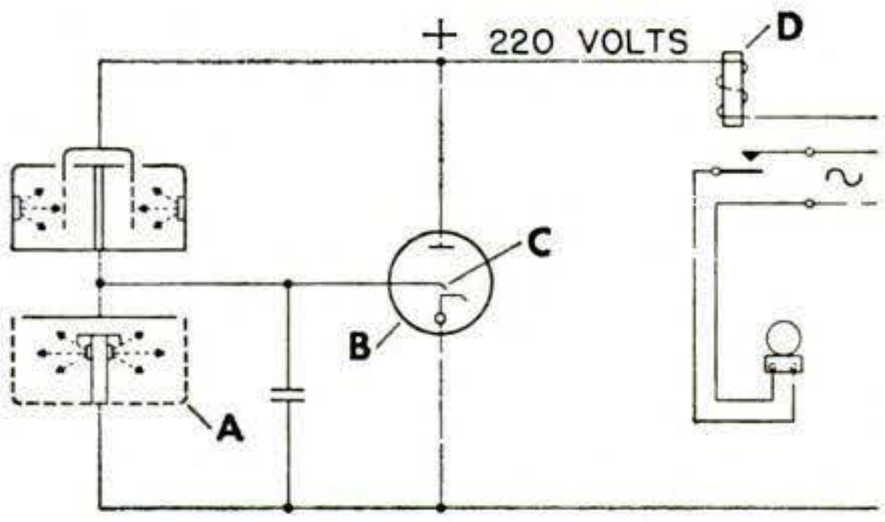
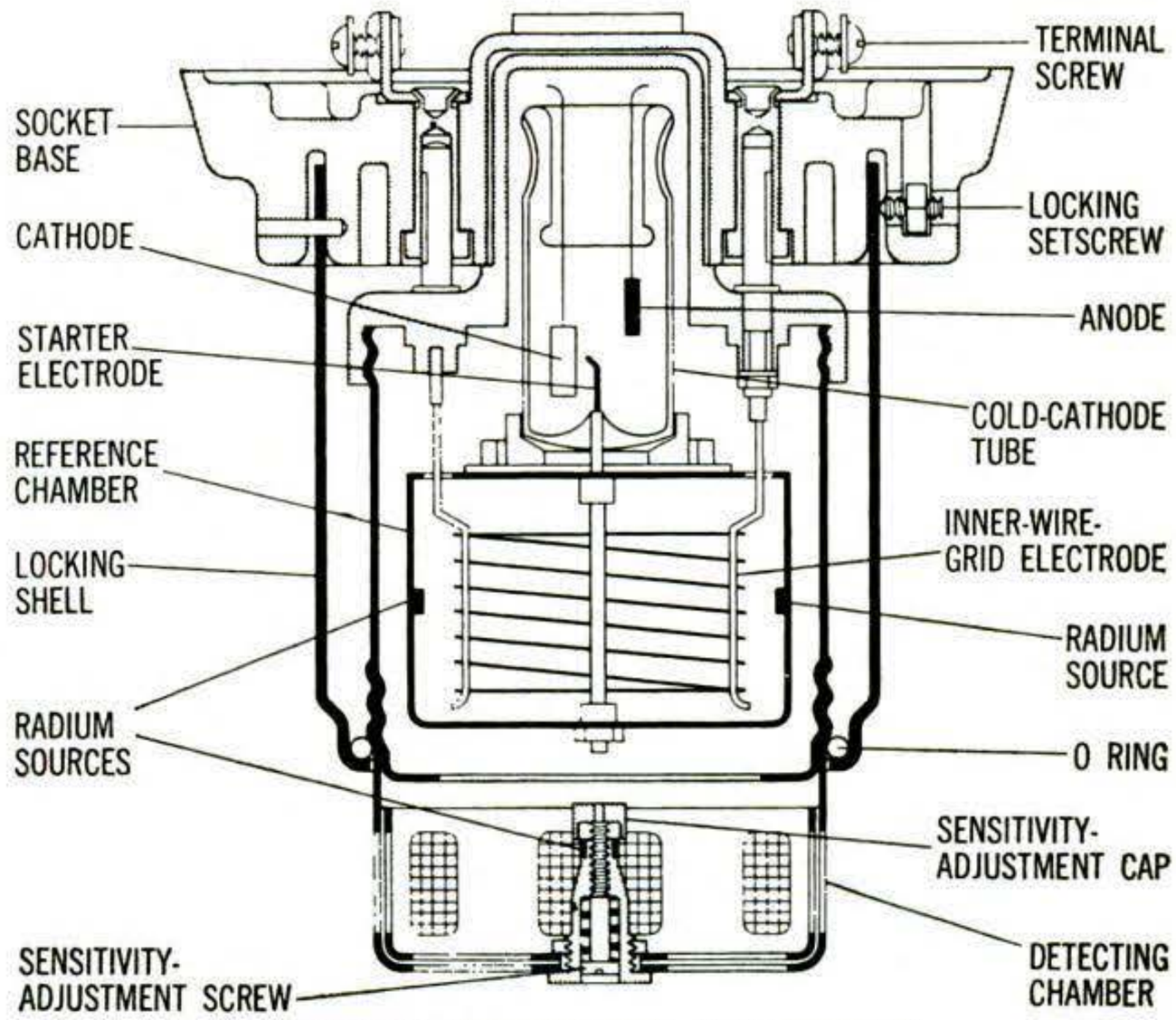
chamber increases the voltage at the trigger electrode of the tube, causing the trigger to activate relays for alarms and signals.

The control cabinet can of course be equipped with contacts for many other functions besides the sounding of an alarm. These include closing fire doors, shutting off fans and ventilating ducts, cutting off power to malfunctioning machinery, turning on emergency or pilot lights in strategic areas, and releasing fire-fighting chemicals.

[Continued on page 262]



WIRING DIAGRAM (above): Air molecules, after entering through a special perforated sampling tube, become ionized in the outer ionization chamber (A) and produce a tiny current that is amplified by the cold-cathode tube (B). A trace of smoke or invisible combustion products sets off the trigger electrode (C), which activates the alarm relay (D). A single detector head protects up to 3,600 square feet. In case of failure in the unit, a closed circuit activates an alarm.



CROSS SECTION OF DETECTOR HEAD

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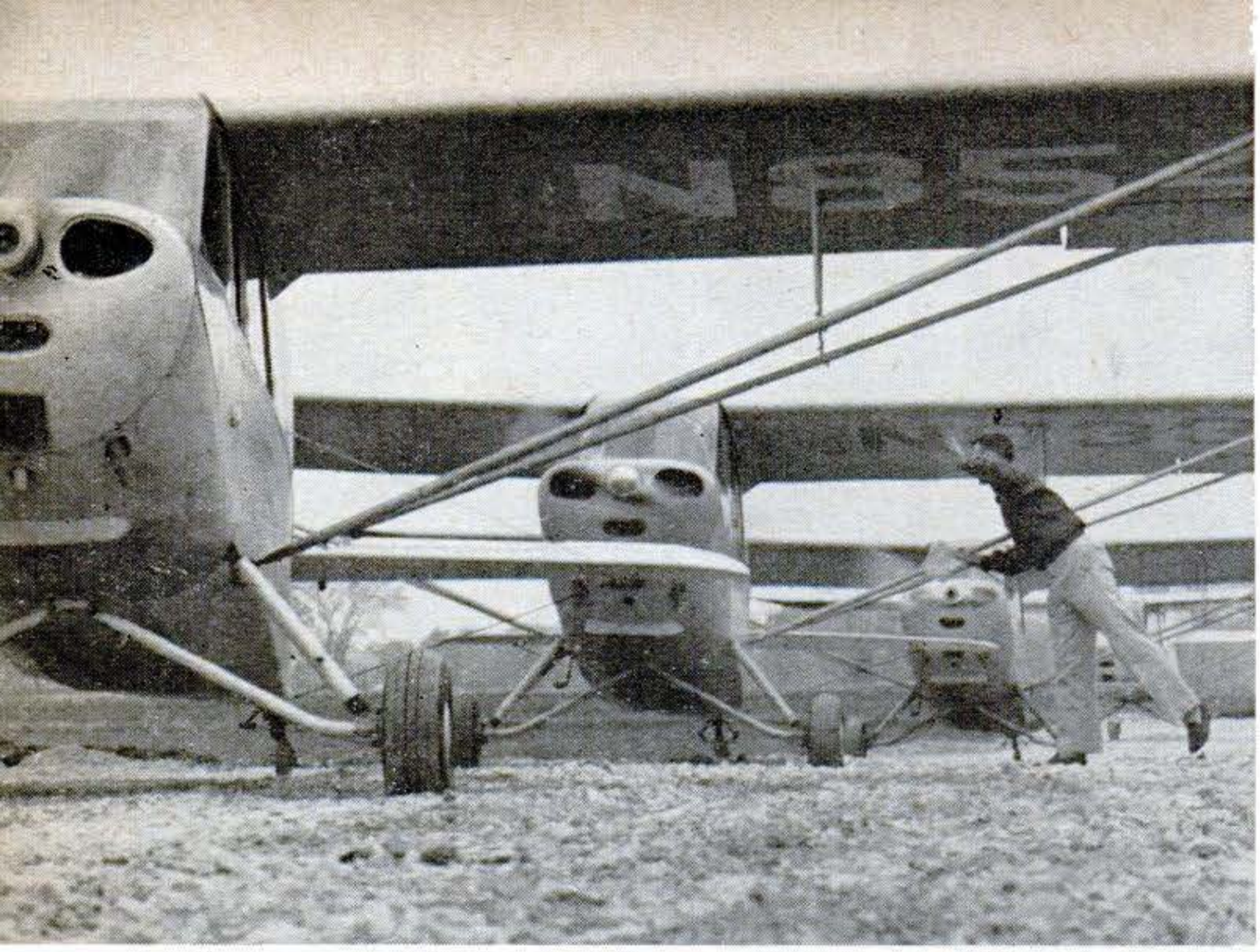


COMPETITORS RUSH FOR COCKPITS on signal from judges. They will roll planes out of line and taxi into position for takeoff.

College 'Bomber' Pilots Try Their Wings

THE sky's the limit now in college competition. This year, teams from 20 schools took part in the annual meet of the National Intercollegiate Flying Association. Ohio State played host at its own airport—Don Scott Field. More than 200 students entered 80 planes, flying them to Columbus from as far away as Stillwater, Okla., and Bozeman, Mont. Grand winner—for the second year in a row—was St. Cloud State from St. Cloud, Minn.

The meet lasted three days and included four events: spot landings under power and dead-stick (with power cut), cross-country navigation, and bomb placement. "Bombs" were paper sacks filled with lime.

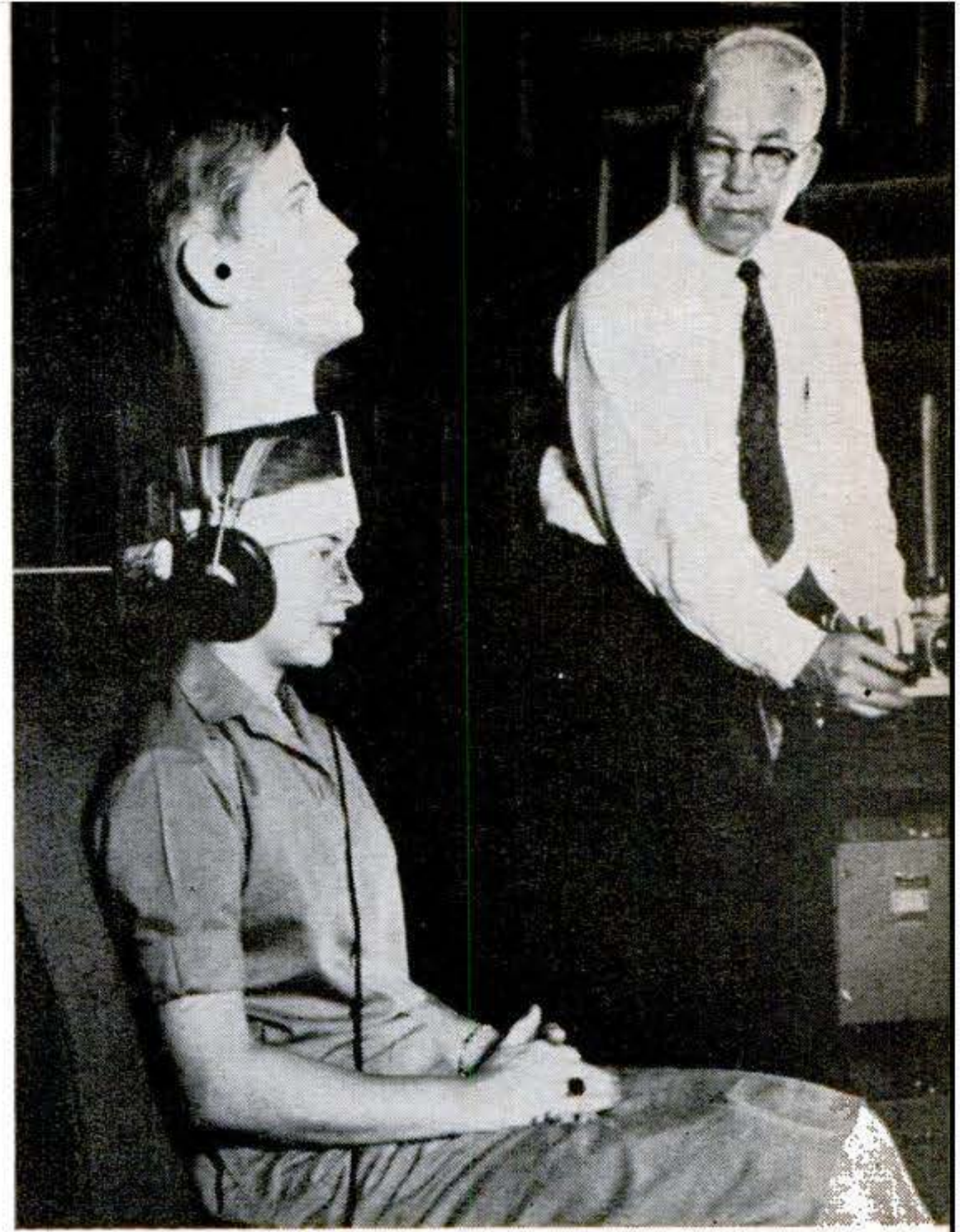
All of the students learned to fly at their colleges, taking regular curricular training courses, with credits toward their degrees. Ohio State, for instance, allows five hours' credit. Many of the young pilots will use their experience in agriculture and business. Some, with further training, may become airline pilots.

LIME-FILLED "BOMB" is dropped on target from plane above. It won't fall straight down. The speed of the plane affects the trajectory to put it closer to the bull's-eye (below).

NEAR MISS IN LANDING as pilot attempts to bring plane's wheels down on field marker.

ENGINE TROUBLE is checked out by pilot and ground crew while waiting for next event.

JUDGES SCAN SKY during pattern flight. Walkie-talkie (left) keeps in touch with tower.



Two heads better than one

The girl with two heads is helping Bell Labs improve stereophonic radio and TV.

The upper head is Oscar the Dummy. Microphones in his ears pick up actual sounds. The lower head belongs to Mary Lou Hartig. Her earphones, connected to Oscar's mikes, hear what he hears, but with a difference: The sound relayed to her is manipulated (delayed or intensified) to determine how she knows which direction it's coming from. She wears Oscar so that minute head movements—important in sound localization—are transmitted to him.

Four-door convertible

Here's a convertible that should be easy on passengers getting in and out of the rear seat: It has four doors. The fancy number was specially built by Ghia on a Chrysler Crown Imperial LeBaron chassis for President Achmed Sukarno of Indonesia. You can get it duplicated for around $32,000.

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Is Noise Damaging Your Ears?

Noise can be dangerous. A doctor tells you how to recognize the peril—before it's too late—and save your hearing

Wave pressures from loud machinery or blasts affect your sound-receiver cells.

By John E. Eichenlaub, M. D.

YOU may, without suspecting it, be running the risk of permanent injury to your ears. The odds are greater than you think, especially if you work around noisy machinery or farm equipment, or you're interested in sports that involve gunfire.

Can you avoid such damage? Probably yes—if you are awake to the danger. Here are the facts:

Sound waves create alternate phases of positive and negative pressure that can inflict mechanical damage on the inner ear. Wave pressures from loud machinery or blasts affect the sound-receiver cells in the fluid of the inner ear. Mild injury makes these cells swell and stop functioning temporarily. Severe or prolonged injury makes them die and disappear.

Most victims of noise damage notice a ringing in the ears before they report any loss. The ringing may be in one ear or both, and lasts day and night (although it's often more

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noticeable in the quiet of the night). It sounds like a continuous high note on a violin.

Patients who acquire their hearing loss abruptly also complain of a "tin ear" that makes everything sound as if it is coming through a cheap radio speaker. Victims of more gradual hearing loss seldom notice this change in quality of sound, for lack of a recent standard of comparison.

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When the quality of a person's hearing first drops, tests show normal hearing in the range of tones used in ordinary speech. It is in the relatively narrow band of frequencies an octave or so above high C that there is severe loss. Further damage, however, instead of affecting those little-used high pitches, spreads the defect down into the speech range.

Tones used for speech become involved from the top down, which is particularly unfortunate since the sounds that distinguish the critical consonants ("p" from "t," "s" from "ch," and so on) are all in the high-pitch range. Eighty percent of meaning, in fact, is conveyed by the high-pitched six percent of voice sound. In noise-induced deafness, you lose the power to distinguish words from one another very quickly, leaving speech a garbled mumble.

The earlier you take steps to protect your ears from further damage, the better your chance of escaping this condition.

Who is vulnerable? About six million industrial workers in this country are exposed every day to noise that can cause ear damage. Operators who stand within three feet of presses, drop hammers, automatic riveters, automatic screw machines, looms, wood planers, wood saws, and dozens of other common machines frequently suffer from noise-induced deafness. Some farm machinery and most hunting guns make enough noise to deafen you. About the only major group not exposed to ear-damaging noise (and they'll never believe it) are America's housewives. The youngsters make an awful racket, but not a truly ear-splitting one!

Tools, such as a pneumatic drill, can cause ear damage. Youngsters make an awful racket, but it's not truly ear-splitting.

With so many sources of ear-wrecking noise, how can you tell whether your own hearing is in danger? Experts suggest that steady or intermittent noise is potentally dangerous if:

- It makes your ears tickle or hurt.
- It prevents your understanding speech without cutting off machinery or moving away from the spot where you usually work.

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- It leaves you with head noises or ringing in the ears.
- Speech or music seems muffled to you immediately after a day's work.

For instance, one of my patients recently mentioned what seemed an odd fact to him.

"I leave my car radio on all the time," he said. "When I get off work in the afternoon, I turn the ignition key and the music comes on. But I always have to turn the volume way up, even though it sounds loud enough at the same setting in the morning."

"I leave my car radio on all the time. When I get off work in the afternoon, I turn the ignition key and the music comes on. But I have to turn the volume up."

Like most people who notice early signs of noise-induced hearing loss, this patient had only temporary damage. A switch to a less noisy work place quickly restored his hearing to normal.

A discharging firearm, dynamite blast, or other literally ear-splitting noise gives you no opportunity for such stitch-in-time action. By the time you realize that something is wrong, your ears may be permanently damaged. Take this case, for example:

A young lawyer went hunting with a rather excitable neighbor. As a partridge started from the brush, the neighbor threw up his shotgun and let fly. The end of his gun barrel was close to the lawyer's head. Result: a permanent hearing defect that makes ordinary conversation at more than five feet distance (and most courtroom activity) virtually impossible.

Never put your head up close to the noise source. Even moderately noisy machinery can destroy hearing if you do.

The specially sensitive. Ear damage from noise shows up much more quickly in some people than in others. A group of airline pilots took hearing tests after four to six thousand hours of flying time. The results, corrected for hearing loss expected from age alone, showed that three-fourths of the men had either no hearing change whatever or only slight loss for high pitches. One in 10, however, had beginning loss of hearing in the speech range.

After 10 to 16 thousand hours of flying time, the most sensitive 10 percent showed definite hearing loss, with difficulty in understanding ordinary conversation more than five feet away. If these few sensitive people had dodged further noise exposure, their hearing loss might never have occurred.

Unfortunately, you can't tell ahead of time whether or not your ears are extra sensitive. Research workers have tried for years to devise a test to sort out workers who can stand loud noise from those who can't. The best they have come up with is a schedule of careful hearing tests for a man's first weeks on a noisy job. If early hearing change indicates noise sensitivity, transfer to a less noisy job usually restores hearing promptly.

How to save your hearing. You can approximate this program for yourself by searching carefully for evidence of ear effects as you introduce yourself gradually to intensive noise.

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Chisel-point nozzle

This fire-hose nozzle, developed at a U. S. Air Force base in England, punches a hole in the fuselage of a crashed plane and reaches in to keep its bomb load from exploding.

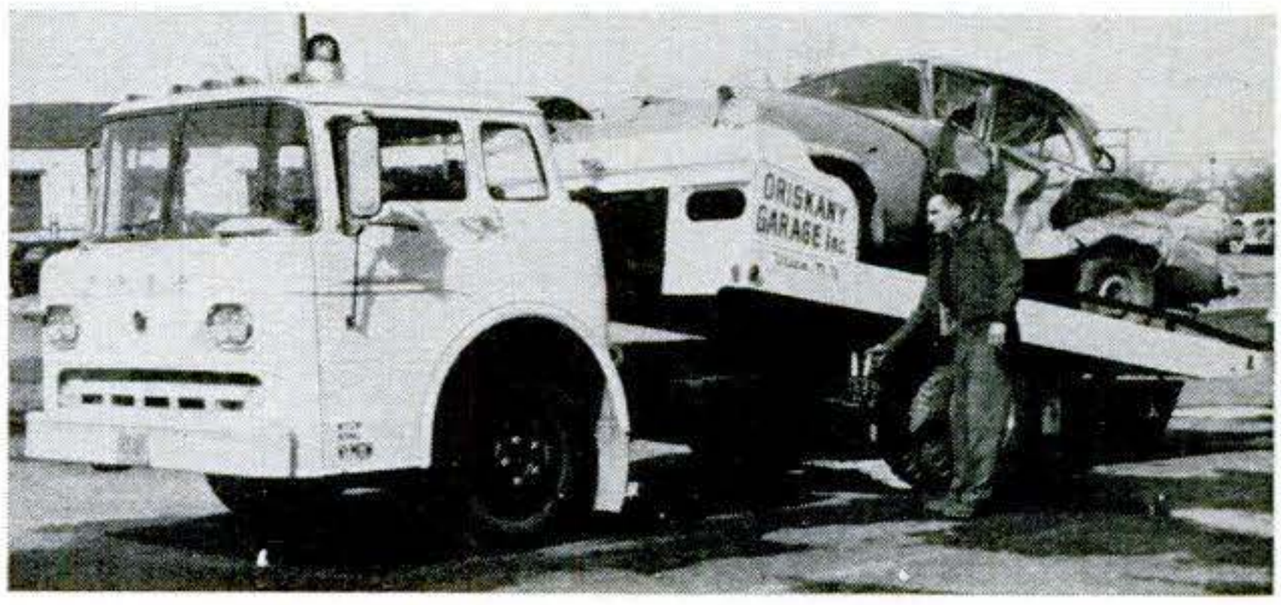
It can fill the bomb bay with 250 gallons of water or 1,750 gallons of foam in one minute. Standard nozzles deliver far less, and fire fighters using them have to break through a plane's skin with axes. The new one is heavy iron pipe with a hardened chisel point. It has handles to make control easy.

Ball is phone booth

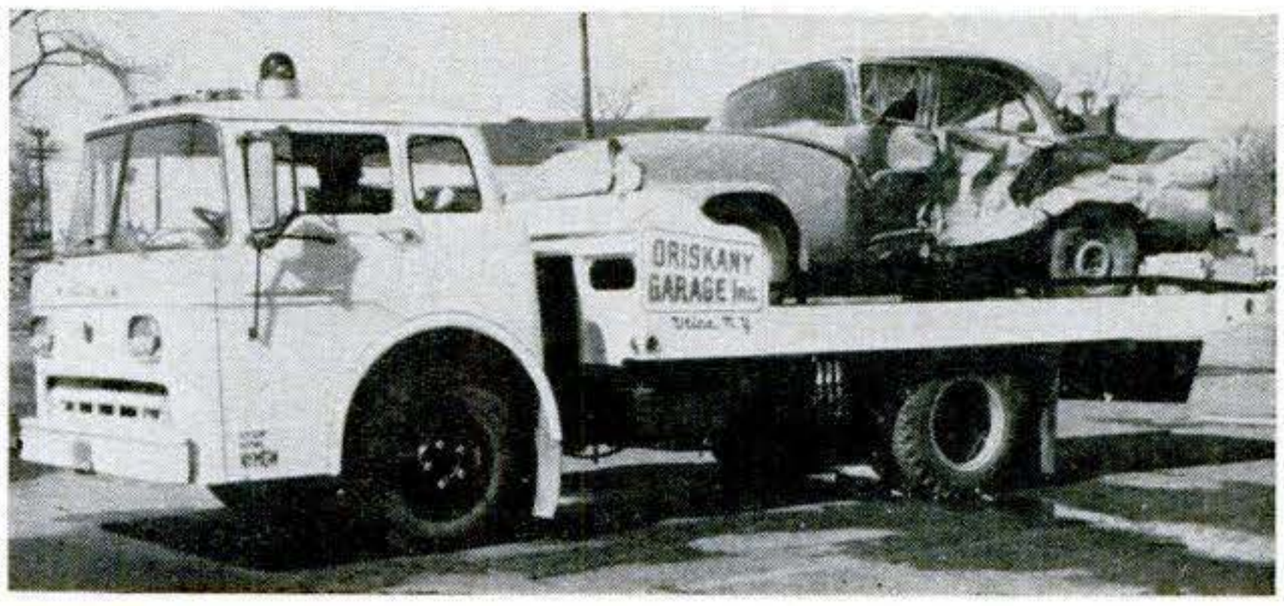
The public telephone above is installed in a plastic ball. When making a call, the girl leans her head into the halved bubble to shut out surrounding noise. The design is being shown at an exhibition in Stockholm, Sweden.

Piggyback wrecker backs up to wreck . . .

. . . winches it onto wrecker's tilted ramp . . .



. . . pulls it up into carrying position . . .



. . . and is set to drive off to the garage.

Gangplank wrecker

Here's a wrecker that takes a disabled car in for repair—piggyback. It has a 16-foot flatbed body that slides eight feet to the rear and tilts to form a ramp. A built-in hydraulic cable winch pulls the car up, and the body then returns forward behind the cab. In addition, there is a detachable pulley on the end of the platform for hauling cars out of streams, up steep embankments, and out of ditches and fields. A tow bar at the back of the wrecker chassis can tow a second car. The wrecker was invented by Joe Klosek, proprietor of a Utica, N. Y., garage.

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Car goes into garage . . .

. . . garage goes into car.

Inflatable garage

This British motorist has no trouble garaging his car when he goes on vacation. He carries the 10-by-12-foot storage unit with him, complete with folding floor. The garage, of lightweight nylon, is held up by a skeleton framework of tubes inflated by a blower powered by the car battery. It packs in an 88-pound bundle, can be put up by one man in only four minutes.

Missile helicopter

The Navy's radio-guided air-to-surface Bullpup has acquired a new launcher. Besides arming fast fighters, the Martin missile has now been fired successfully from Marine helicopters.

Hung on a starboard rack on a Sikorsky HUS-1, it has been shot at ground targets from altitudes of 500 to 1,500 feet with no adverse effect on stability.

It's guided by a switch on the pilot's control stick, will supplement assault troops' firepower.

He rides the river

The flashy convertible at right was further converted by Richard B. Cronin of Detroit into a speedboat. He mounted an old Buick body on a boat hull and took a spin on the Detroit River.

Shortly after this photo was taken, the aquatic convertible collided with a brand-new 23-foot cruiser and knocked a three-foot chunk out of its stern. Only damage to the Buick was a dented fender.

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Now . . . Little Batteries Put Power Anywhere

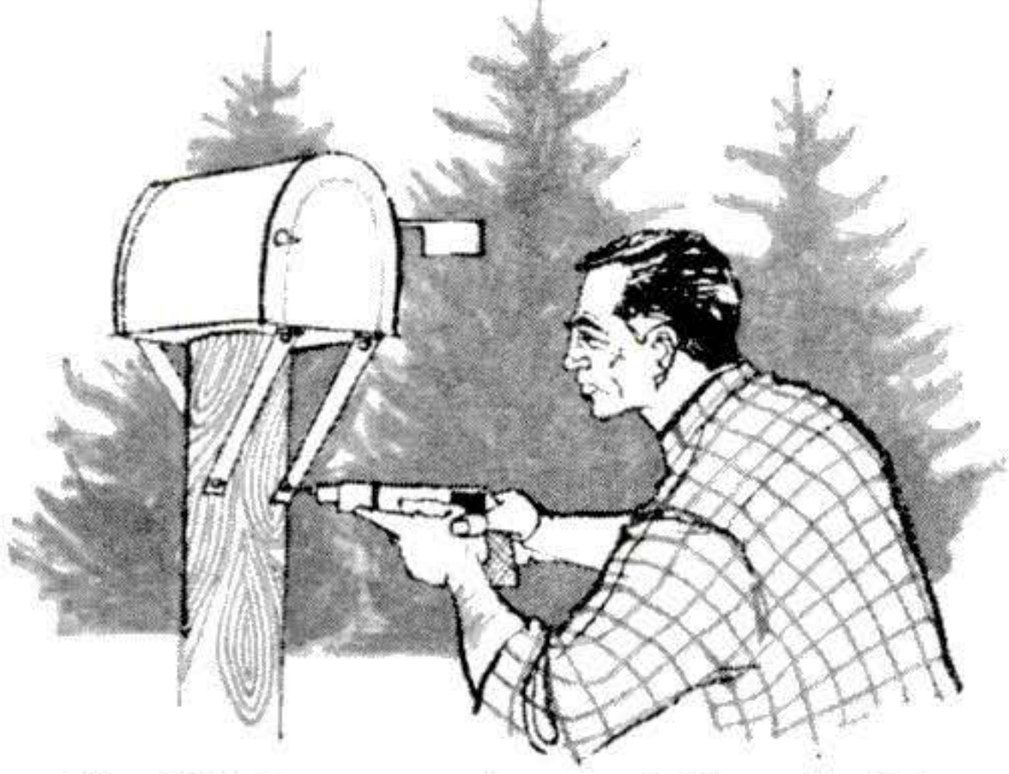
The new rechargeables are small, lightweight, spillproof, and long-lived. They're making more portables possible

RIGHT NOW . . .

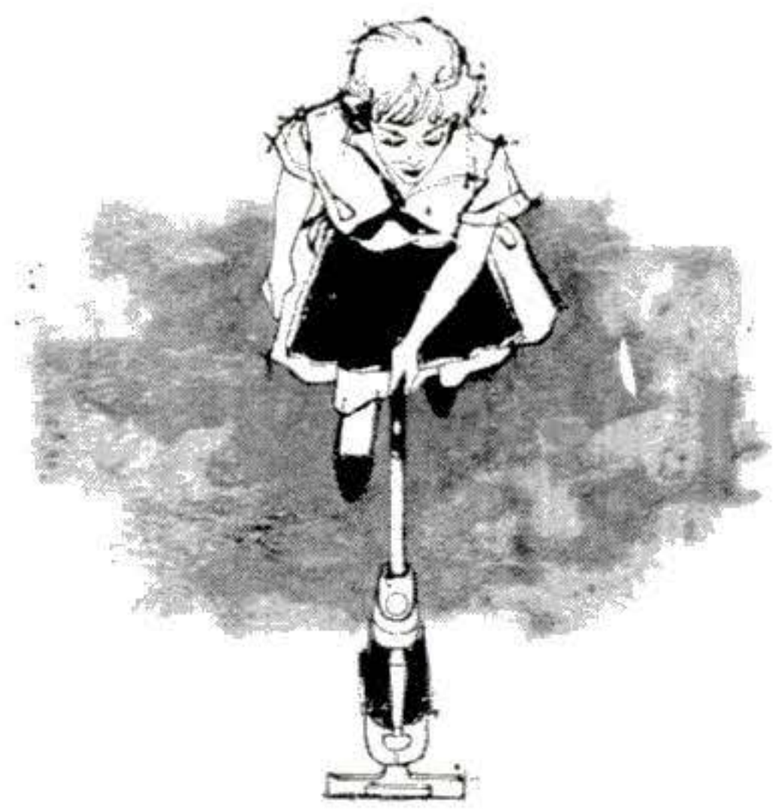
You can get a clean shave in the woods

Or watch television while you row

PRETTY SOON . . .



You'll bring your electric drill to the job



Or hear her say, "Look—no cord!"

By Robert Gorman

NEXT month—if you have the inclination—you can combine World Series television with a camping trip in the remote backwoods. For large-screen, portable TV has finally broken free of the electric outlet.

Self-powered television is the latest recruit in a fast-growing army of appliances that store electricity for hours of cordless, convenient use, and are then recharged in off hours. You can already shave electrically—or take sound movies—while canoeing in midstream. But before long you may be able to carry a cordless electric drill to the job. And by next year your wife may be doing her vacuum-cleaning without trailing cord from room to room. Nor will the kids be forgotten. Electric toys powered by economical, high-energy, long-lasting rechargeable cells are on the way, too.

It's not just that storage batteries are taking over jobs formerly done by dry cells. They are opening a whole new range of applications. Although a revolution in packaged power is in the making,

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it may be difficult to recognize because it has waddled—rather than leaped—upon the scene. Batteries are essential to the new developments, even though electronic advances have stolen the limelight.

Fewer volts needed. Transistors, semiconductors, and other subminiature workhorses have sharply reduced the power needed by electronic gear. Compact, lightweight equipment can now handle a vast number of full-size jobs. Motorola's new fully transistorized TV portable, for instance, operates a 19-inch picture tube on an input of less than 20 volts at 1.5 amperes.

But this achievement would have little value without a suitable source of power. The five-pound silver-cadmium battery pack developed by Yardney Electric Corp. delivers the needed current at constant voltage for five to six hours. It can be recharged at least 500 times.

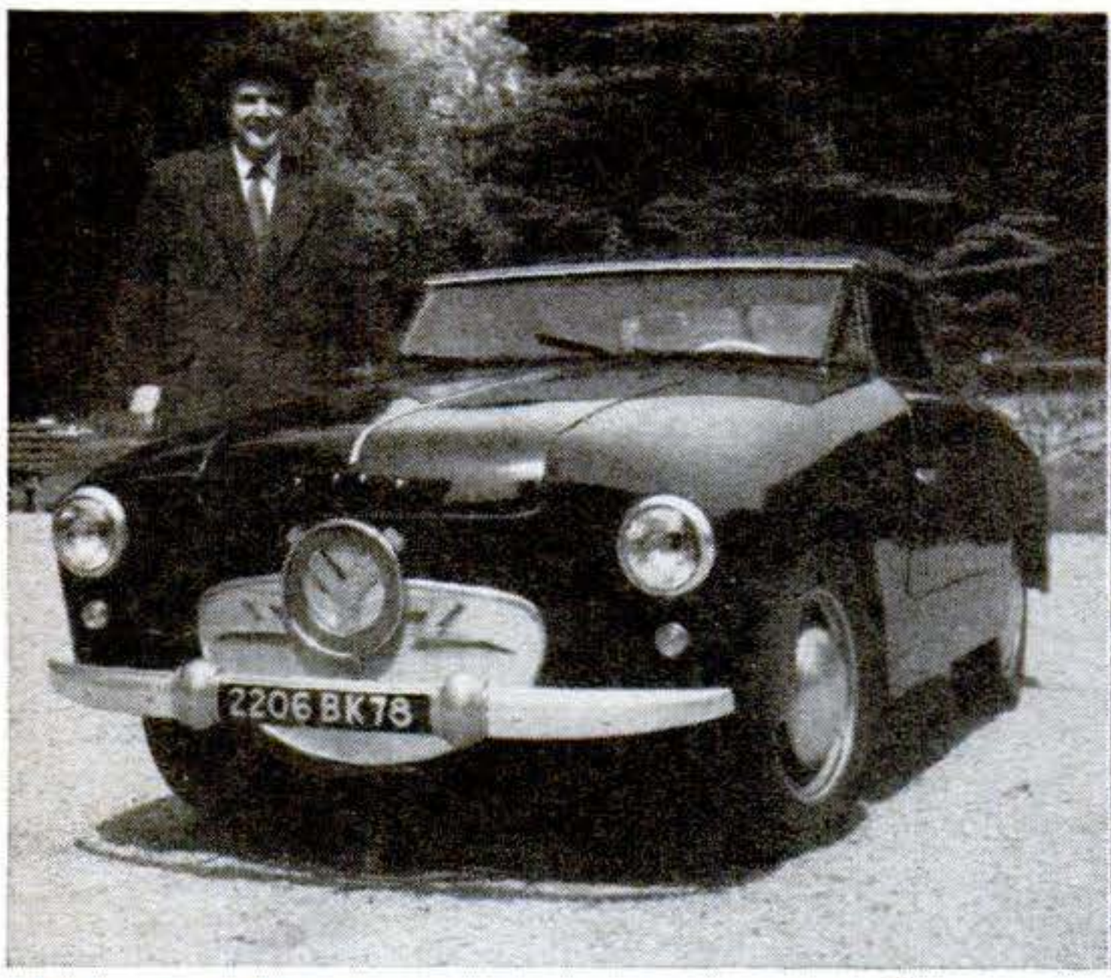
Rewriting the book. Recent developments have toppled a host of familiar rules about batteries. One thing hasn't changed, however. Electricity is generated by a chemical reaction within the individual cells of a battery. In a "secondary," or rechargeable, battery, the action has to be reversible: The chemical process that causes the charge to flow out must turn around when a new charge is put back in.

Regardless of its size, the cell of any practical battery will develop an electrical pressure of one to two volts. But a larger cell will be able to deliver more amperes of current for a longer period of time. And by joining cells in different combinations, batteries of almost any voltage and of widely varying current-storage capabilities can be made.

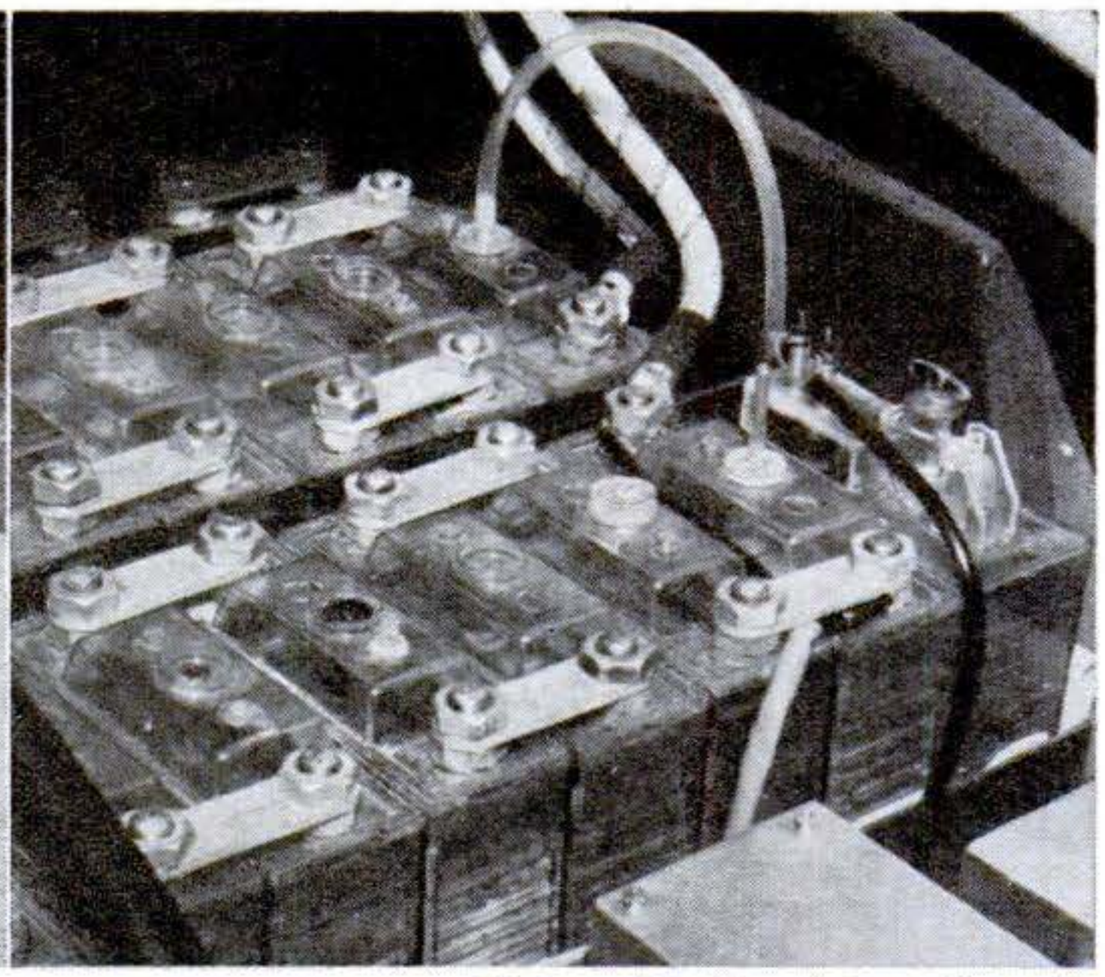
Electricity can be generated by many different chemical combinations. It has been known for at least half a century that such combinations as nickel and cadmium, silver and zinc, and silver and cadium are high-energy "couples." Since they are also reversible, they are ideal for use in compact storage batteries.

The big problem—control. The breakthrough in modern rechargeables came not from discovering these favorable combinations, but from learning how to control them. In the past, storage batteries had to be protected against excessive charge or discharge, because either condition can evaporate water from the liquid electrolyte. (The electrolyte is a kind of messenger that carries the reactive agents back and forth.) The charge or discharge process can also generate gases that have to be vented to keep a battery from popping its seams.

Once we learned to live with these limitations in the familiar lead-acid car battery, it grew easy to overlook their importance: A battery's dependence on water and air limits it to fixed-position jobs in which it isn't likely to leak or



DYNA-PANHARD ELECTRIC CAR runs at a top speed of 48 m.p.h. Prof. Henri Andre, who designed the car's battery, is shown above.



UNDER THE HOOD of Dyna-Panhard is a 56-cell, 256-ampere Yardney silver-zinc battery. One charge will power the car for 150 miles.

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spill. It needs auxiliary equipment to regulate the charge-discharge cycle, and its useful life depends on periodic service and maintenance.

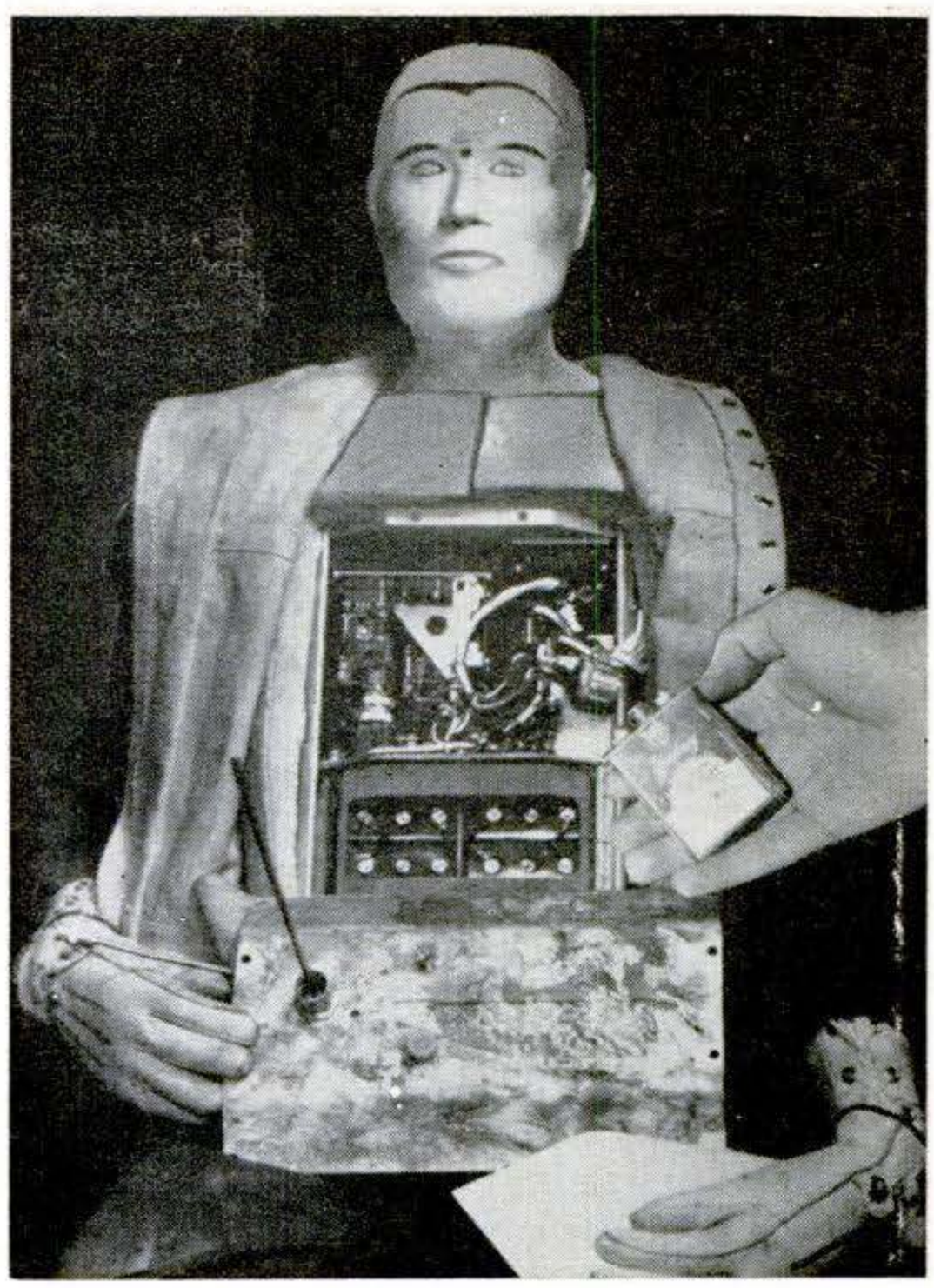
A rechargeable flashlight. The first major step in freeing rechargeables for wider use came out of West Germany about 10 years ago. A technique was developed for limiting gas pressure inside a sealed nickel-cadmium cell. In effect it stopped chemical action when the cell was charged to capacity. A second development protected against the tendency of an over-discharged cell to reverse its polarity. The results showed up in a small, spillproof pocket flashlight that could be recharged from any AC outlet. It was so immune to abuse that it could be recharged at any point in the discharge cycle, or left plugged in on recharge for days at a time.

Since then a number of French inventions have made silver-zinc and silver-cadmium batteries practical and spillproof. Partly because of their high cost, silver cells show up mostly in military or industrial gear: missiles, satellites, undersea cameras, torpedo-guidance systems. They're also used in "Hurricane Sam"—the six-foot mechanical and electronic stand-in robot for human flyers in space-age endurance tests.

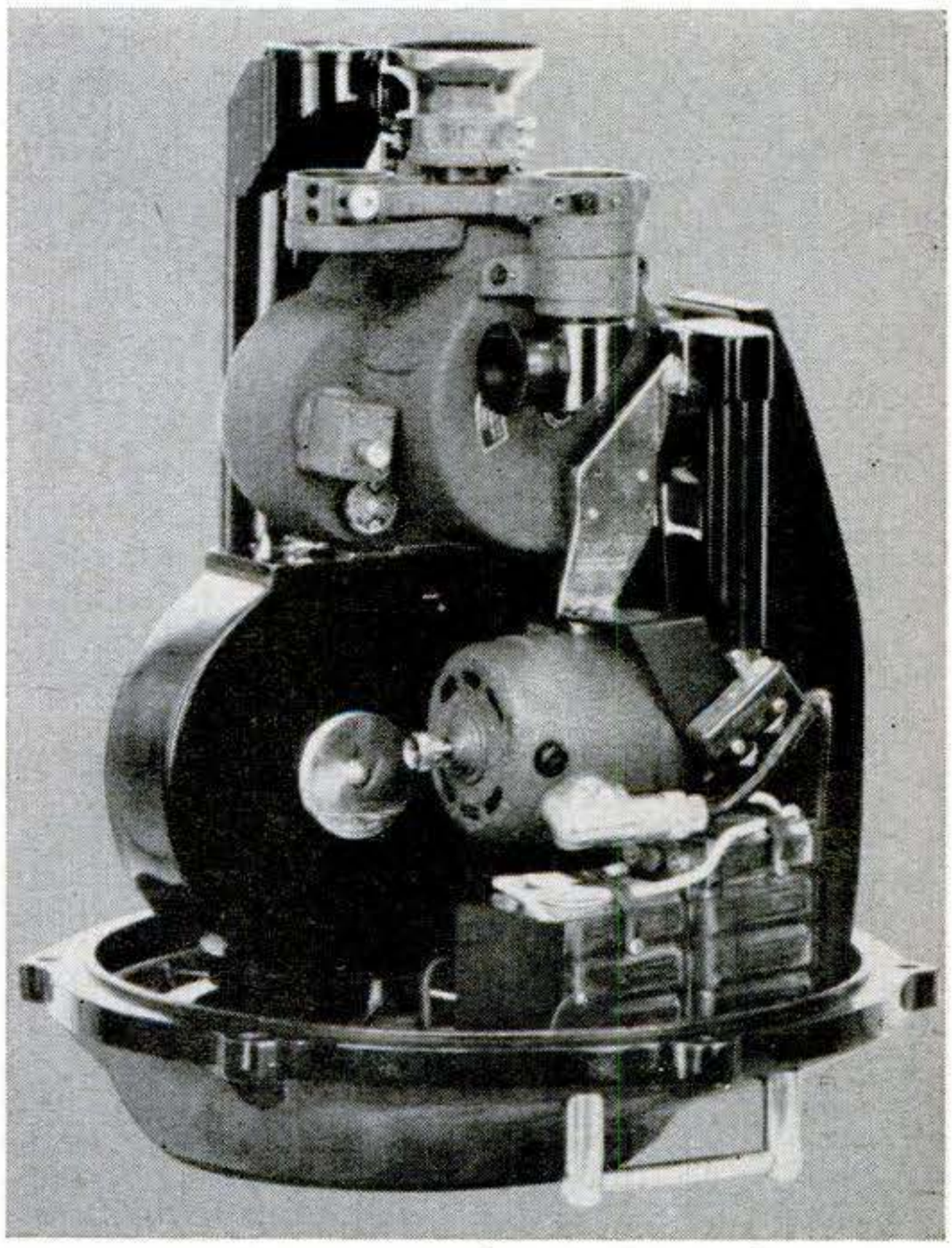
Rechargeable dry cells. American engineering has refined and expanded the European advances—often producing batteries that defy the old-time classifications. For example, the new technology has toppled the long-standing distinction between rechargeable wet cells and one-shot dry cells. The reason: A sealed battery doesn't need, in fact, can't accept, a refill. So it no longer matters whether the electrolyte is liquid or not. Limiting evaporation has therefore made many types of rechargeable dry cells possible.

One-shot wet cells. Some of the jobs now being done by batteries have created a need for a cell of this kind. Many battery-powered defense items have to be stockpiled for long periods of time, yet must be ready for action at a moment's notice. But batteries can lose a large part of their energy just standing idle.

One solution has been to seal a liquid electrolyte in a separate container inside a battery. That way the whole package



HURRICANE SAM'S "HEART" is a Silvercel battery. In a 1,500-m.p.h. sky-leap from Utah's Hurricane Mesa, the battery ran the instruments that measured the robot's reactions as well as the transmitter that sent them back.



UNDERWATER CAMERA shown above also uses a Silvercel battery. The 89-pound camera, made by Sampson-Hall of Hollywood, can be used at depths of 150 feet without pressurization.

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VANGUARD III parts were photographed before the satellite was launched on September 18, 1959. A standard rechargeable Silvercel battery powered instruments that measured solar X rays, environmental conditions in space, and the earth's magnetic field. The battery also powered two transmitters that sent data for 89 out of a scheduled 90 days. The 50-pound moon, now silent, is still in orbit.

can be stored indefinitely in a dry, uncharged condition. Puncturing the liquid container instantly turns the separate parts into a fully charged battery.

One-shot rechargeables. Confusing classifications further, technologists now also need batteries that can be partly recharged a few times. The guidance system of a missile or torpedo is about as pure a one-shot application as you could ask for. But too much rides on that one shot to trust any device that hasn't been pretested. So a breed of one-shot rechargeables has been developed. Put through their paces in advance, they can be brought back to full power for the pay-off job.

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My Most Embarrassing Shop Moment

PLANNING to paint the outside trim of my house one weekend, I had risen early on Saturday morning to get off to a good start. On my drill-press table in the garage I placed an open gallon bucket of white paint. Chucked in the spindle was a ¼" rod, which I had formed into a mixing paddle. With the paddle lowered into the paint, I locked the spindle and turned on the motor. But instead of the pulley belt being set for the slowest speed, as I had thought—it was set for maximum.

The shaft whipped the full bucket off the table and began whirling it around in front of my whitening face. Every revolution smacked the bucket against the centerpost of the press, creating a centrifugal snowstorm of four-hour paint. Because of the whirling bucket, I was unable to get to the motor switch until at last I found a stick with which to poke the toggle.

When the clatter died, the battered bucket was almost empty, most of its contents having done a nice job of beautifying and preserving my car (naturally a window had been open), the inside of my garage, and me.

A lot of people have chuckled over this incident in the three years since it happened. Recently, I've just begun to see the humor in it myself.—*Paul Fryar, Canoga Park, Calif.*

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Do you have an embarrassing shop blunder that haunts you? PS will pay $50 for each such experience published. None can be returned. Keep it brief. Address: Shop Editor, Popular Science Monthly, 355 Lexington Ave., New York 17, N. Y.

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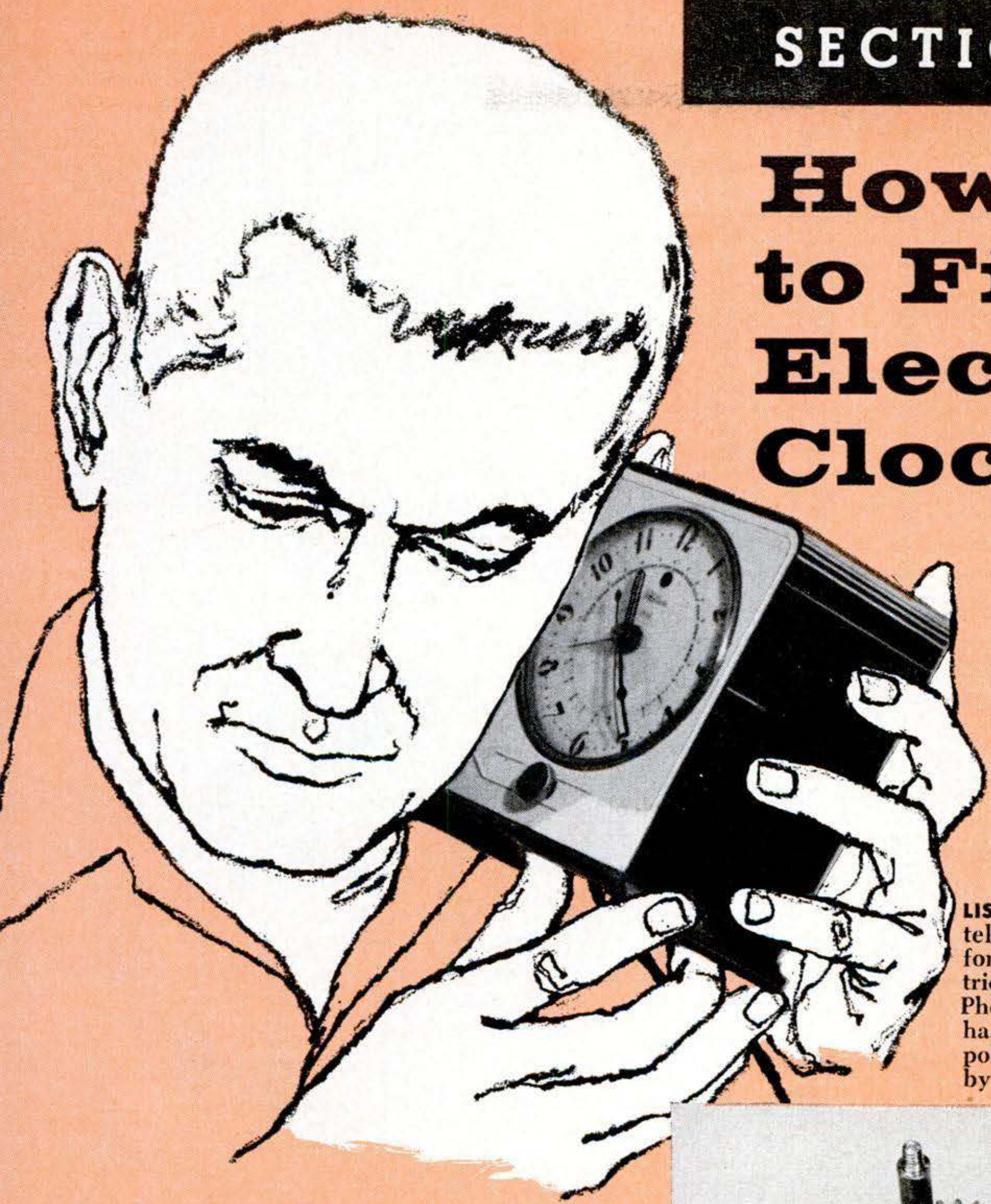
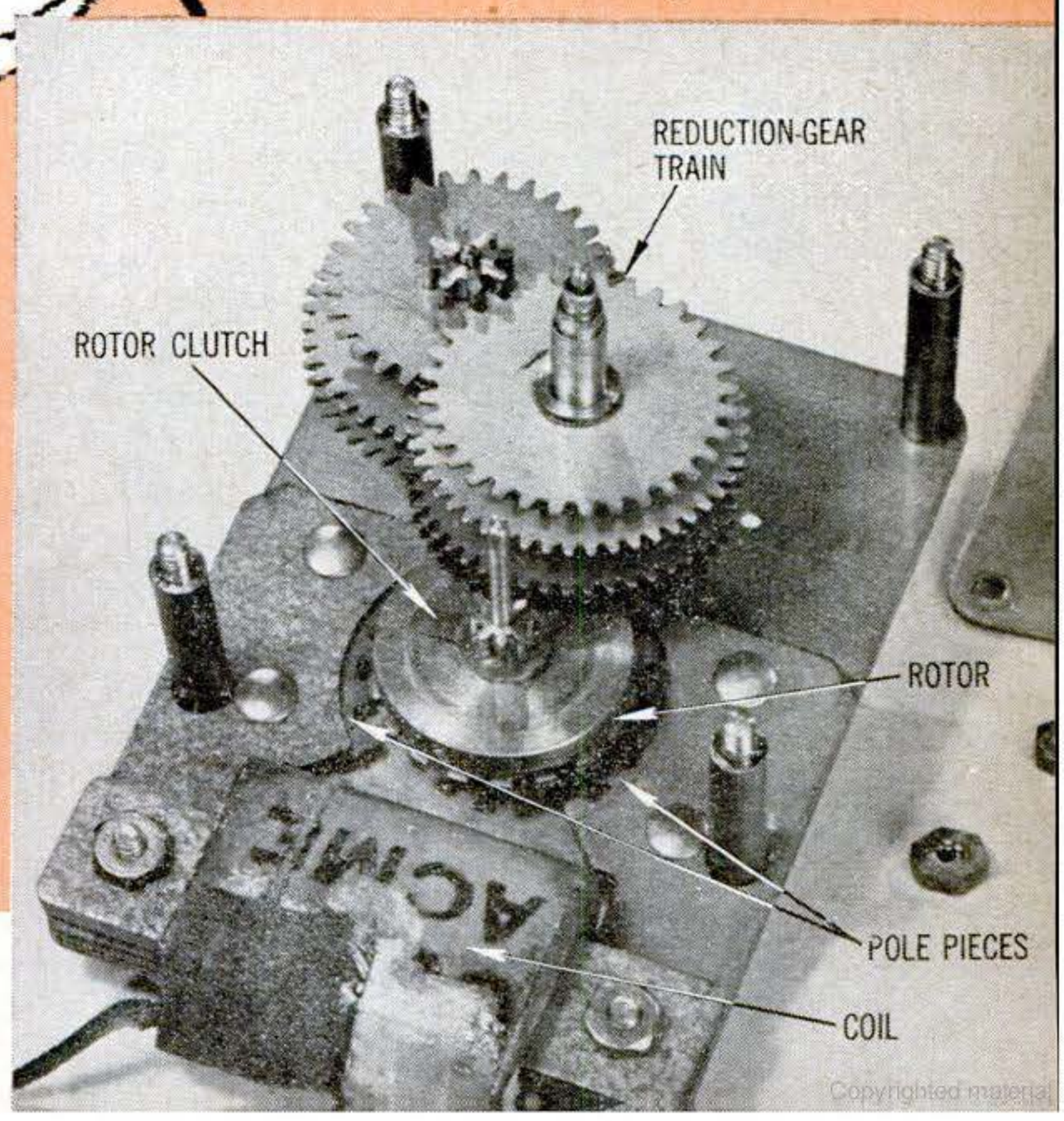
How to Fix Electric Clocks



LISTENING will usually tell you whether to look for mechanical or electrical troubles. Below: Phonic-wheel clock drive has toothed rotor and pole pieces. It is started by twirling a knob.



By Walter E. Burton

FIXING an ailing electric clock is easier than you may think. Your self-confidence may have been shaken by previous experiences with a windup clock, but you can take courage—an electric clock is just a slave unit.

It doesn't "keep" time—it simply enables you to read, in your home, a master clock at the power station. As long as its wheels turn freely and AC current flows through a coil inside, an electric clock will report the time accurately. There

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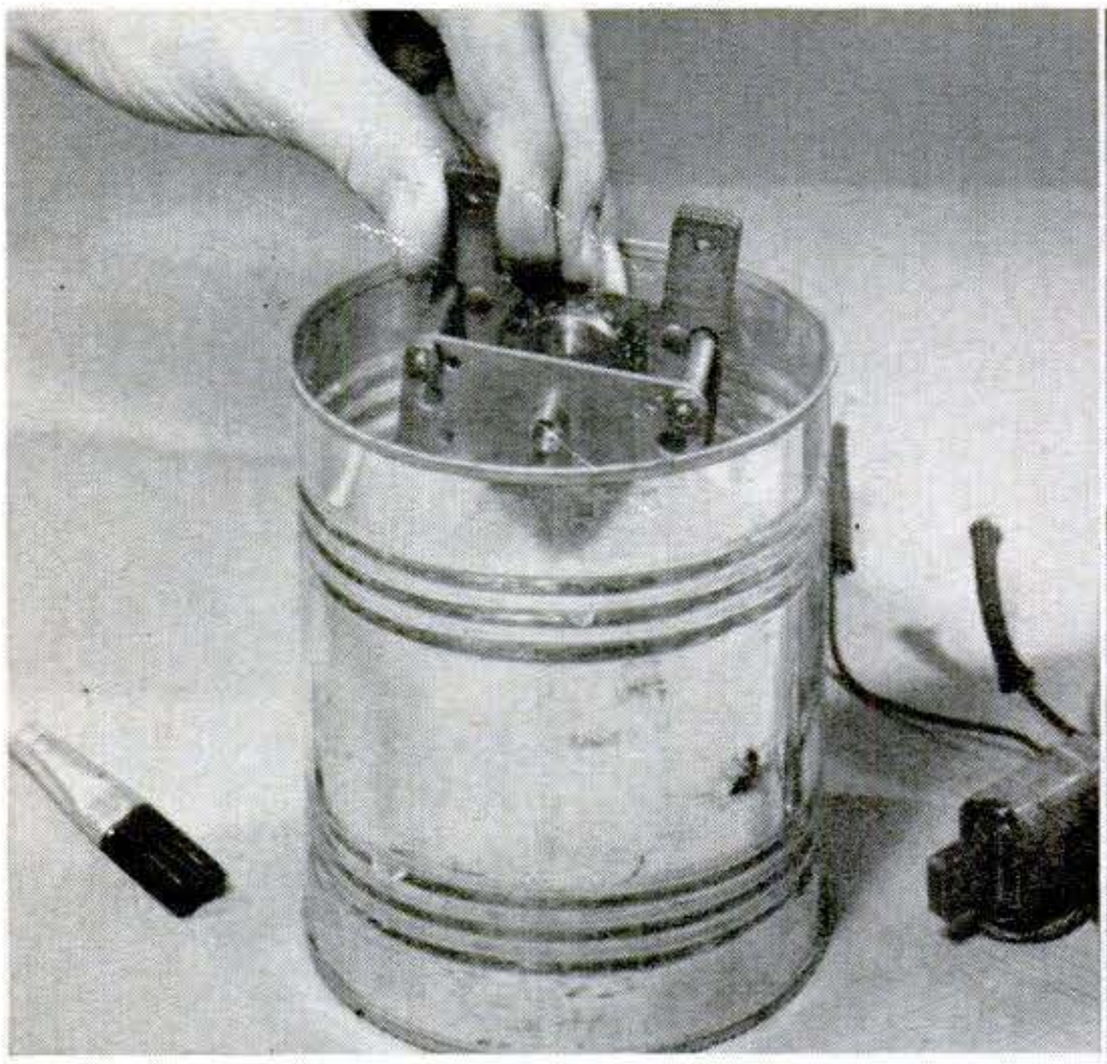
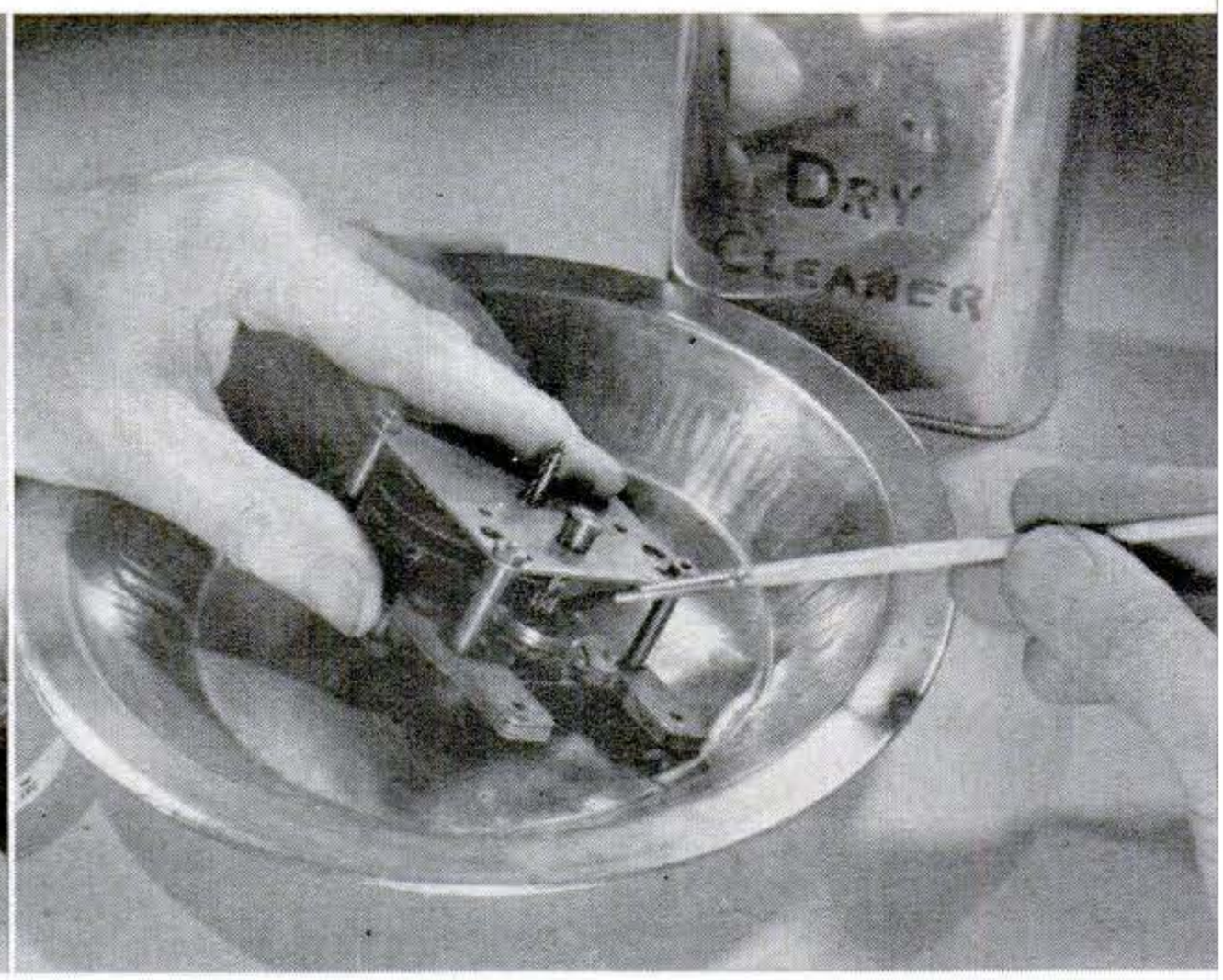
How to clean and oil open works



DUNKING is the best way to clean open works, but be sure to remove the coil and dial first.



WASH AND RINSE with an artist's brush dipped in solvent if dunking the works is not feasible.

How to replace, or perhaps salvage, a noisy sealed rotor

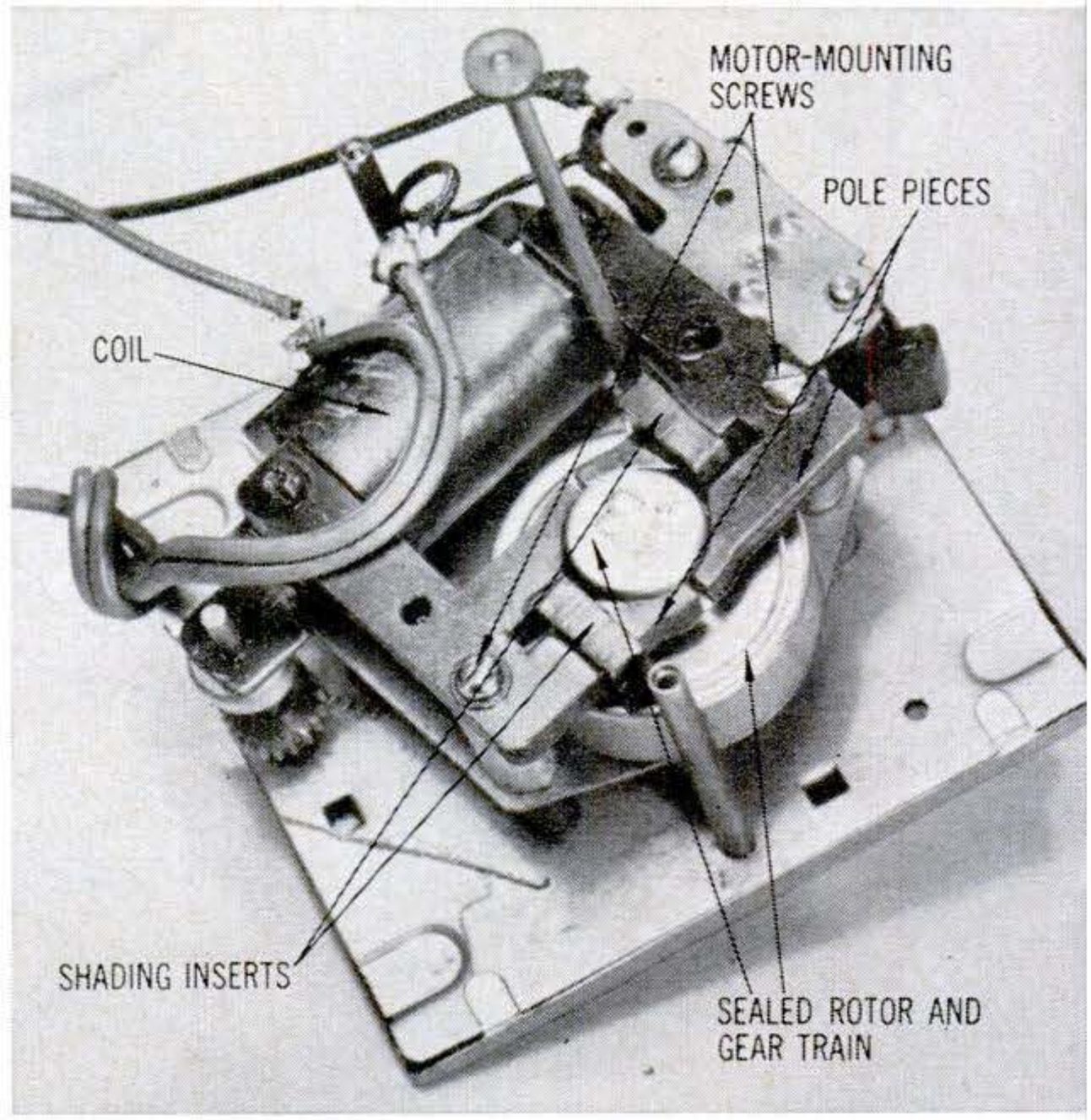
are no balance wheels to upset, no hairsprings to get mangled, and no tricky escapement mechanisms.

What goes wrong? You can quickly tell whether the trouble is mechanical or electrical. Plug the clock into an outlet and hold it close to your ear. If you hear a steady power-line hum, electrical parts are probably okay. Look for mechanical troubles:

- Interference with the movement of the clock hands.
- Dirty, gummed, or dry gears and bearings.
- Frame, gears, or shafts bent or sprung.
- Gears improperly meshed.

A loose crystal or buckled dial face will often slow or stop the hands. The hands may rub against each other as they pass. A sliver of glass from the crystal may become lodged between a hand and the face. Observe carefully through a complete revolution of the hands for possible interference. Straighten a buckled face; cement a loose crystal; use tweezers to bend the hands gently if they rub and to remove any foreign particles caught in the space between face and crystal.

Cleaning and lubrication procedures will depend on the kind of works you find



SEALED-ROTOR MOTORS appear to have no moving parts. Sealed in oil in the same housing with reduction gears, rotor spins at 3,600 r.p.m.

inside. They all have a rotor that turns at fairly high r.p.m.s and a gear train that drives the hands. The main differences are in the design of the rotor and the degree to which the machinery is sealed inside closed containers. The three types are:

- Phonic-wheel rotor. These are found in the old-fashioned clocks that you

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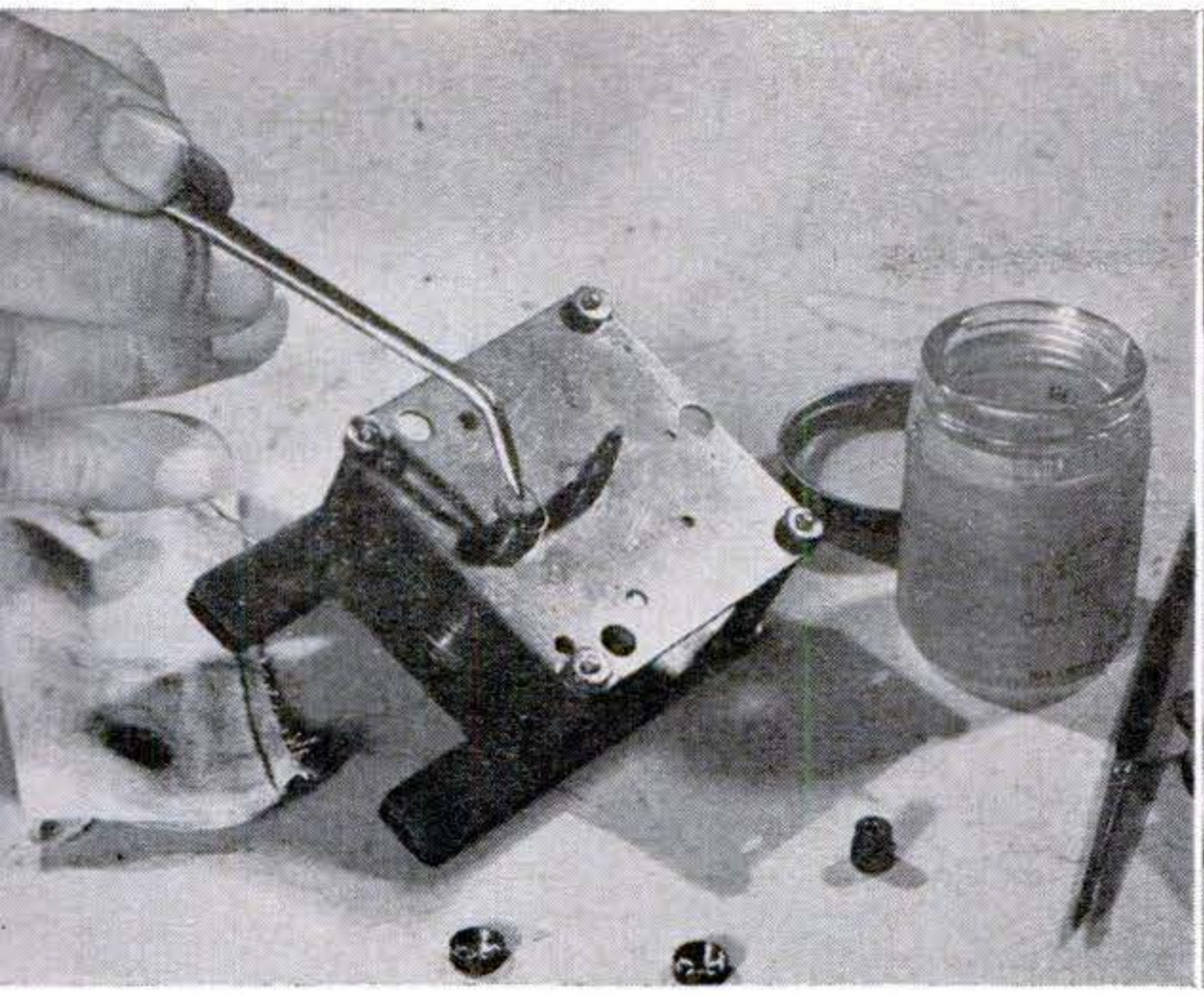
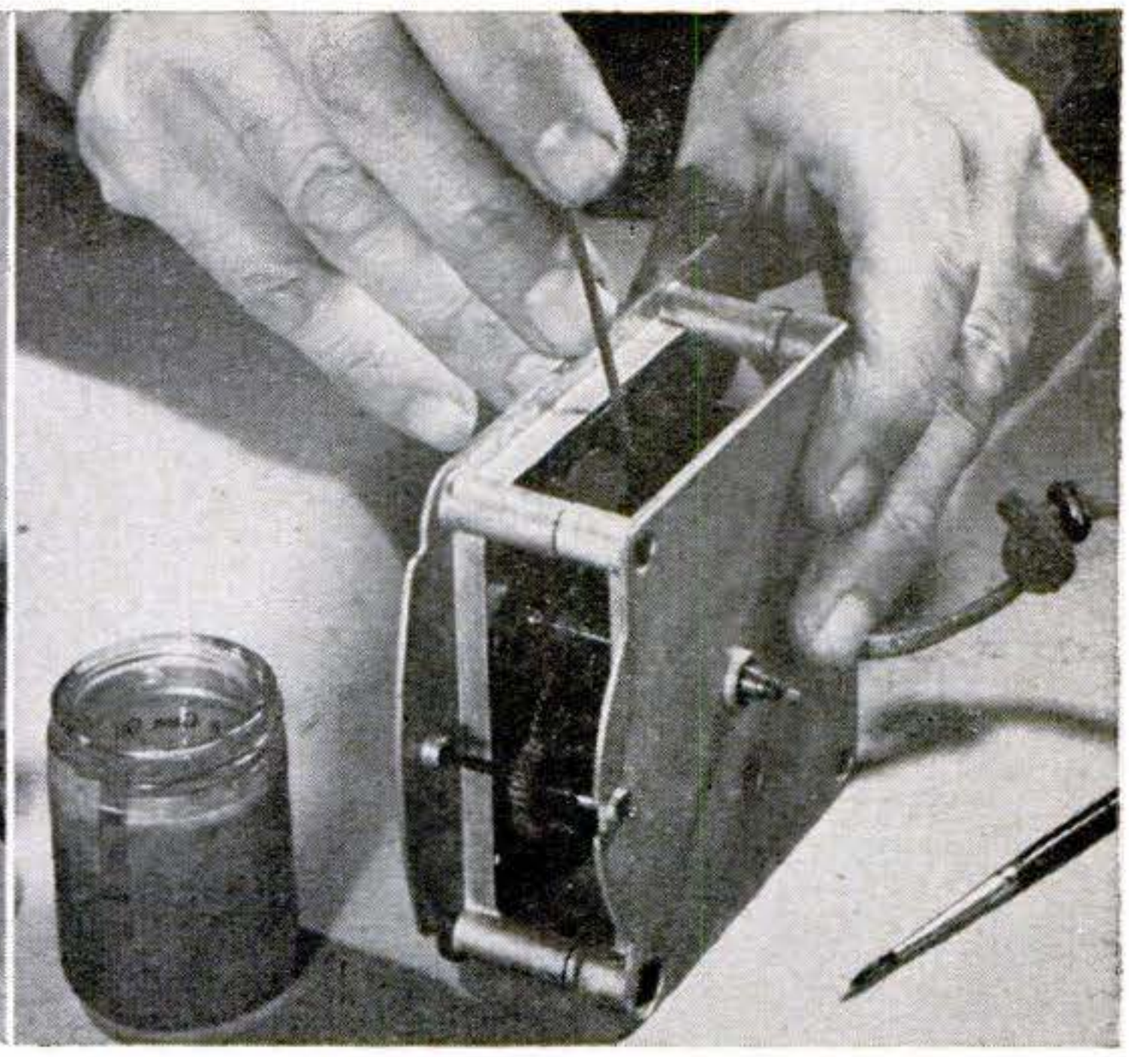
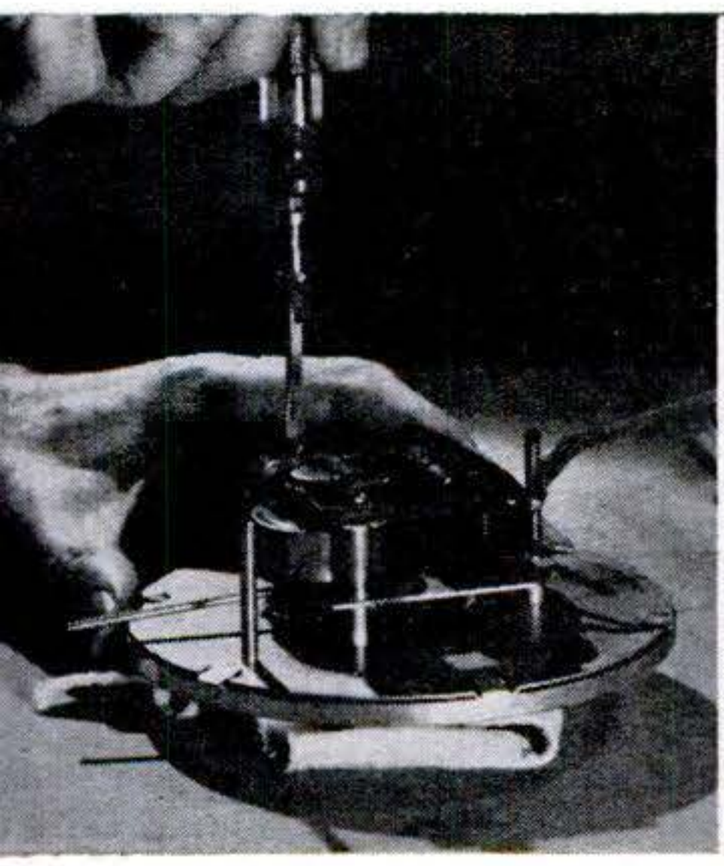


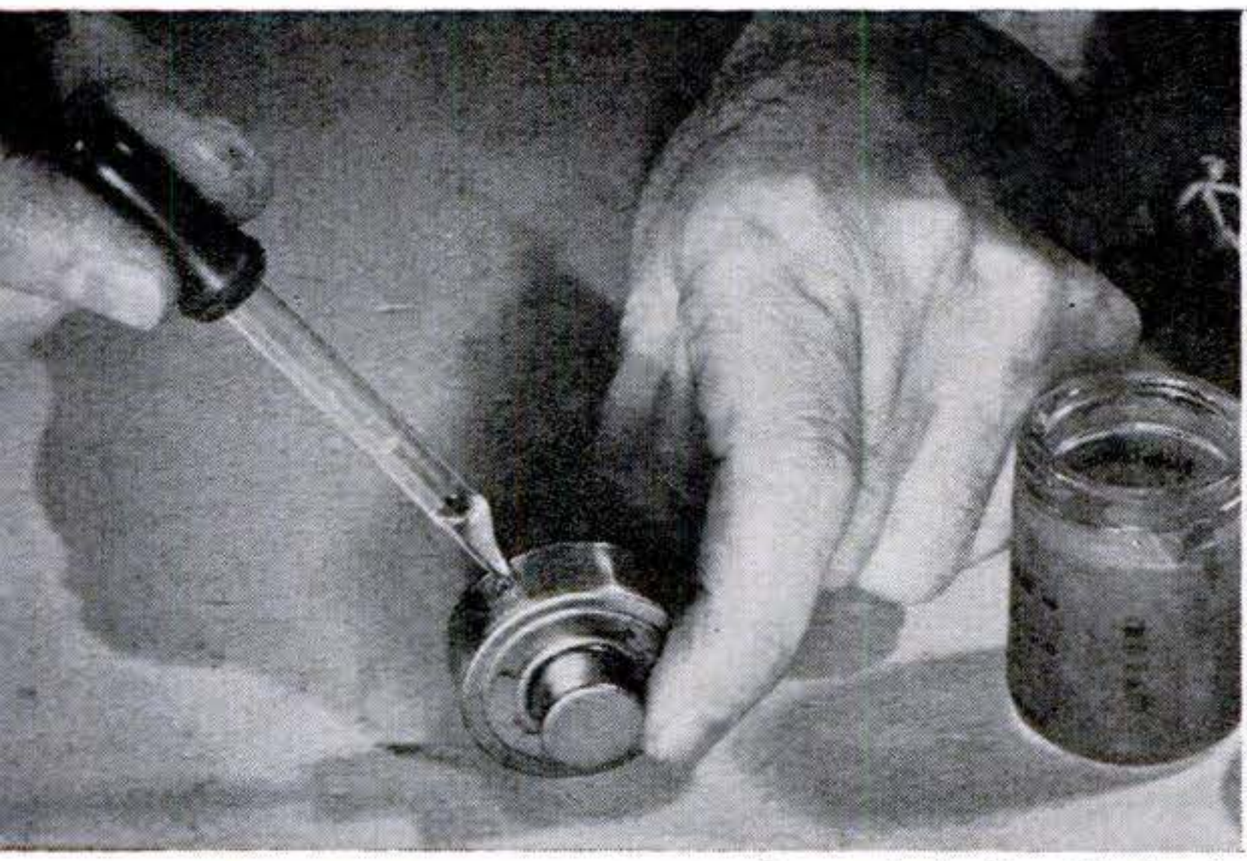
REMOVE ANY FELT OIL PADS, wash them in solvent, blot dry, saturate with oil, and replace.



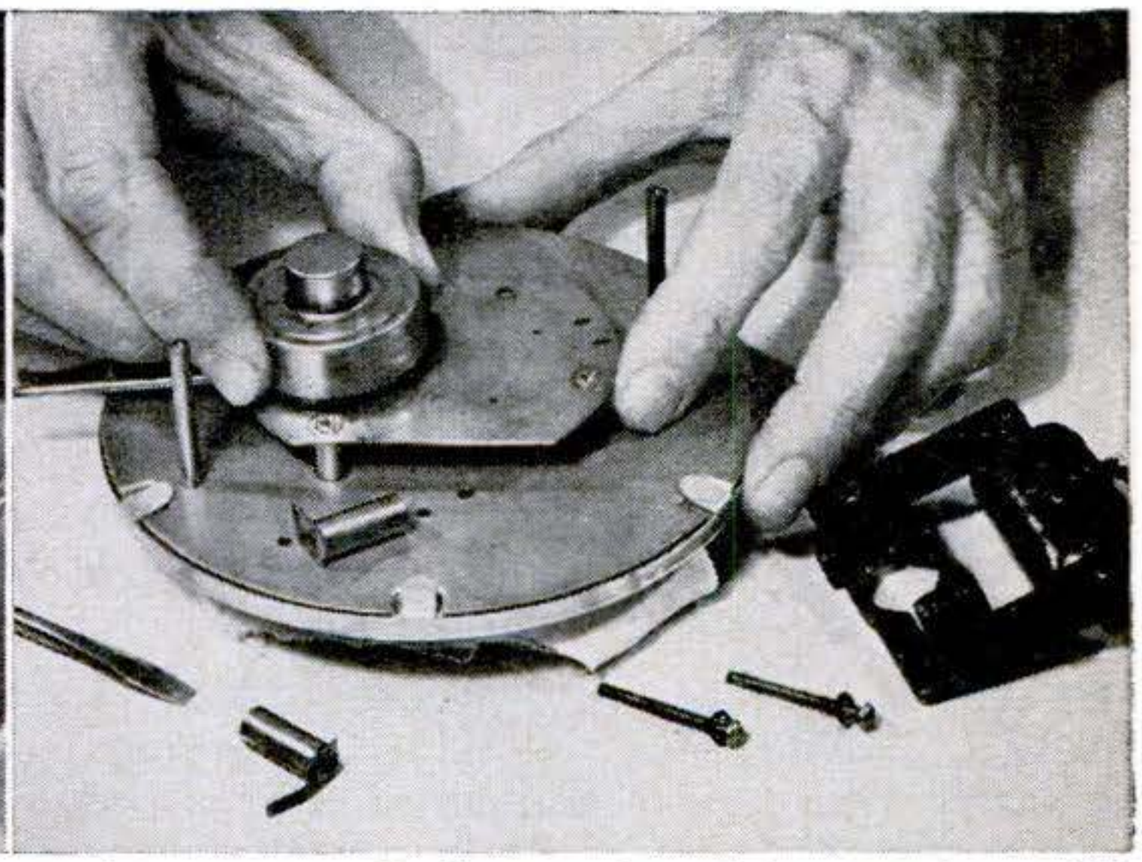
OIL ALL WORKING PARTS using a piece of wire to carry one drop to each friction point.



REMOVE MOUNTING SCREWS and lift off rotor-coil assembly. Push rotor housing from its niche between the pole pieces. Use a drill to make a thin place in the housing opposite the drive pinion. Break through with a punch to avoid getting metal particles inside the case.



SQUIRT CLEANING FLUID through hole. Shake it around, then out, and squirt in oil. Plug hole with solder or epoxy glue. To reassemble, position rotor unit first so its pinion meshes with matching gear. Fit pole assembly on neck of rotor housing and push it into place.



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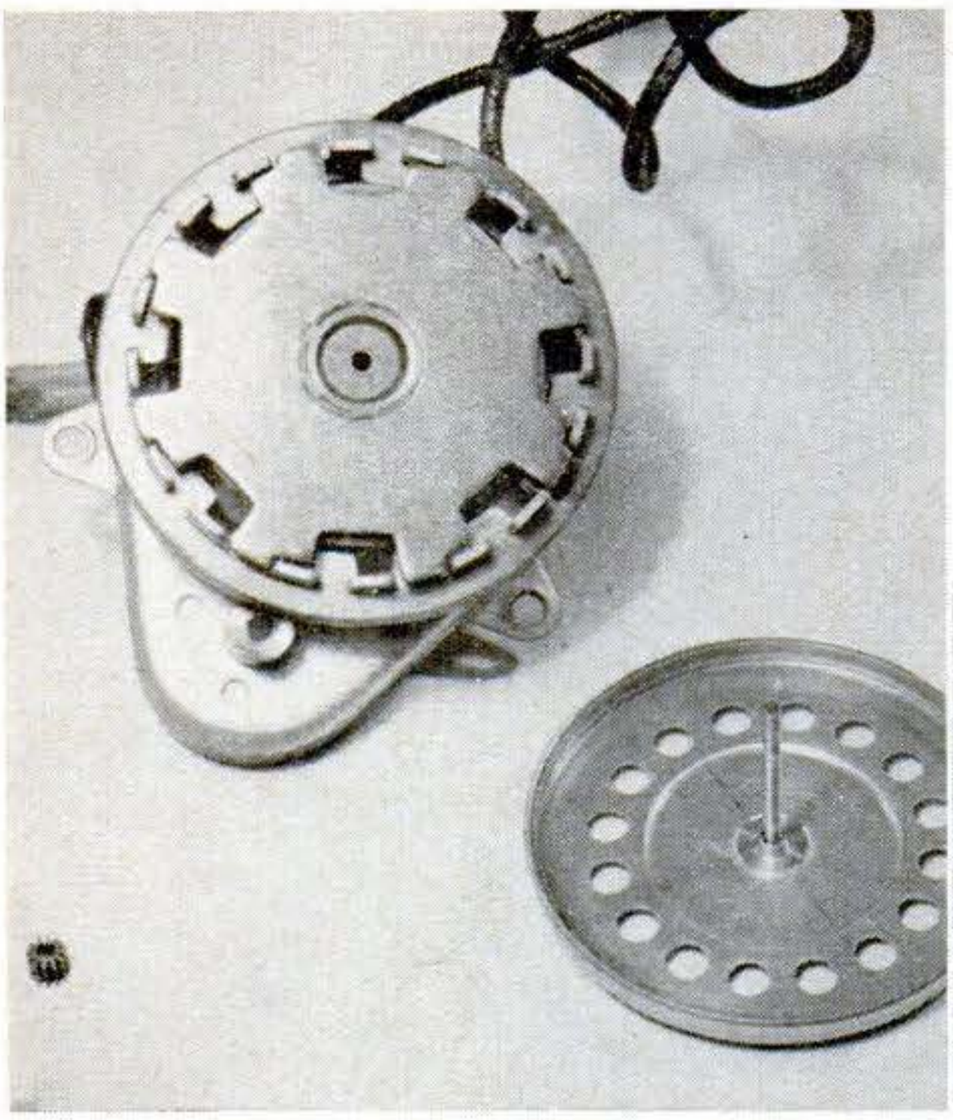
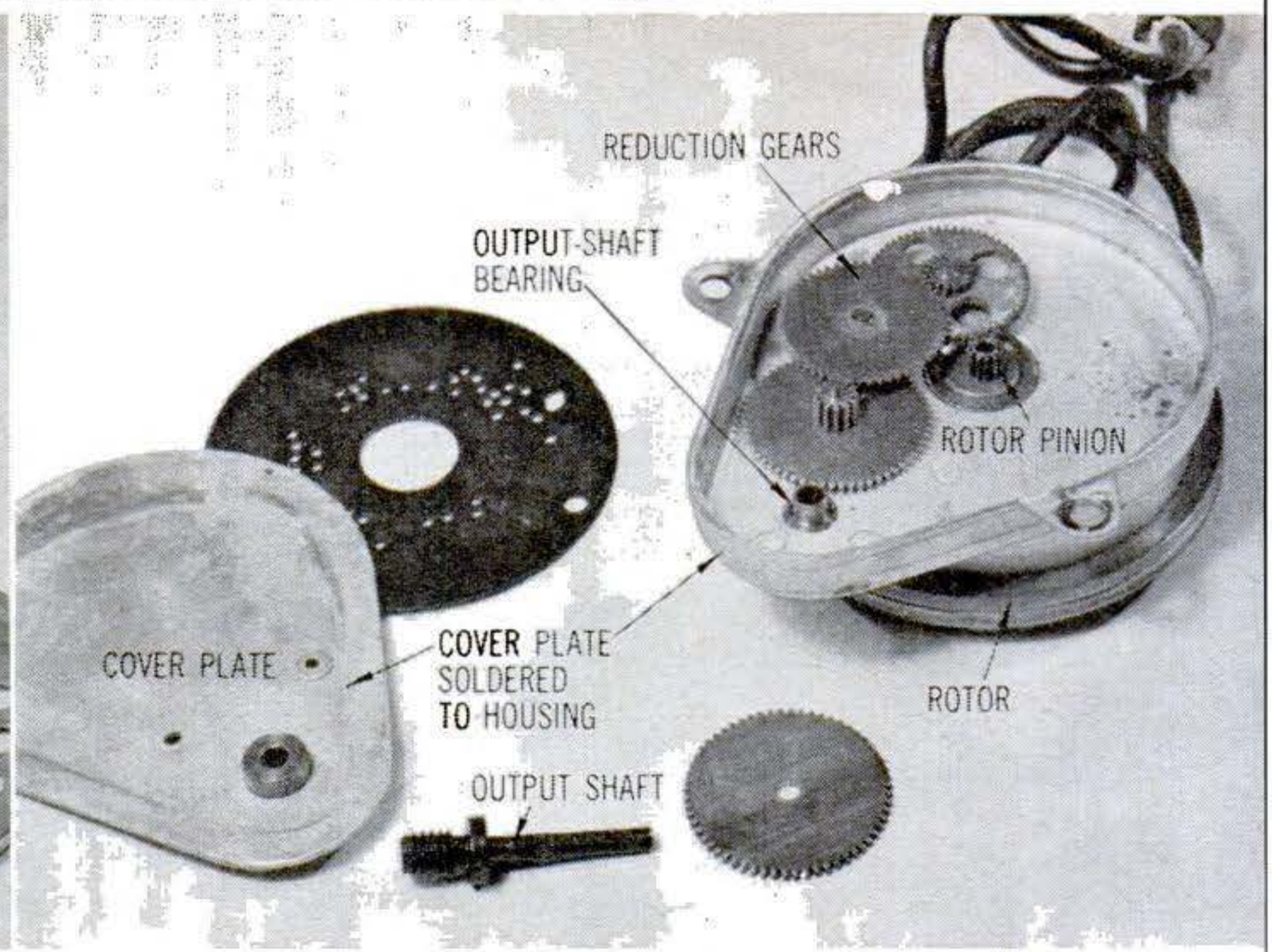
Inside a multiple-shaded-pole motor and enclosed gearcase



MULTIPLE-SHADED-POLE clock motor has notched pole plate with coil underneath. Rotor is thin metal stamping with holes or slots in it.



ENCLOSED REDUCTION-GEAR HOUSINGS usually can be opened, if necessary, by melting the solder around the edges of the cover plate.

start by spinning a knob. The works are usually unenclosed.

- Multiple-shaded-pole, self-starting. Variations of this type are used in a wide variety of clocks. In more expensive ones much of the works, including the rotor, will be enclosed. Cheaper clocks are often completely exposed when the outside case is opened.
- Sealed rotor. A small high-speed rotor is inside the neck portion of a sealed housing. The neck fits tightly in a cavity between pole pieces of the field coil.

Cleaning. Best way is to dunk open works in solvent; but this is practical only if the field coil, dial, and other parts that might be harmed by solvent can be easily removed. Ordinary household solvents can be used, but commercial clock-cleaning preparations are best. Using a two-part commercial cleaner, dip the works in the first bath, swish it around until the goo is softened, then remove and drain. Put it in the second bath for rinsing. (Cleaners may be bought from jewelers' supply houses. If you can't find one, Akron's Jeweler's Supply, Inc., First National Tower, Akron 8, Ohio, sells a cleaner and rinse for $1 each per quart, plus postage.)

If stripping the works seems like too much trouble, you can still do a reasonably good job without dunking. Use a small artist's brush dipped in solvent for local application. Rinse the same way.

Lubrication. About the only thing as bad for a clock as a dry bearing is too much oil. After cleaning, apply a good clock oil—sparingly. Experts favor a nonmineral type. (If you have trouble finding this, it's available from Fulcrum Oil Co., 1243 Liberty St., Franklin, Pa.) Use a straightened paper clip to put one drop of oil at a time at the friction points in the clock.

Sealed-in-oil rotors used in GE-Telechron clocks require different treatment. The manufacturer recommends replacement, if the trouble is found to be inside the rotor case. GE says the replacements are available from local GE clock-service stations (recommended factory list price, $1.75). Photos show how to remove and replace this unit. However, it's a good gamble that you can restore the old one by following the procedure shown in photos on the preceding page. If it doesn't work, you've lost nothing but time.

Look for small holes in the soldered-on cover of enclosed reduction-gear housings. One way to get oil into these is to use an empty squeeze-bottle dispenser. Place the dispenser nozzle over one open hole and use the bottle as a vacuum pump to create a suction. At the same

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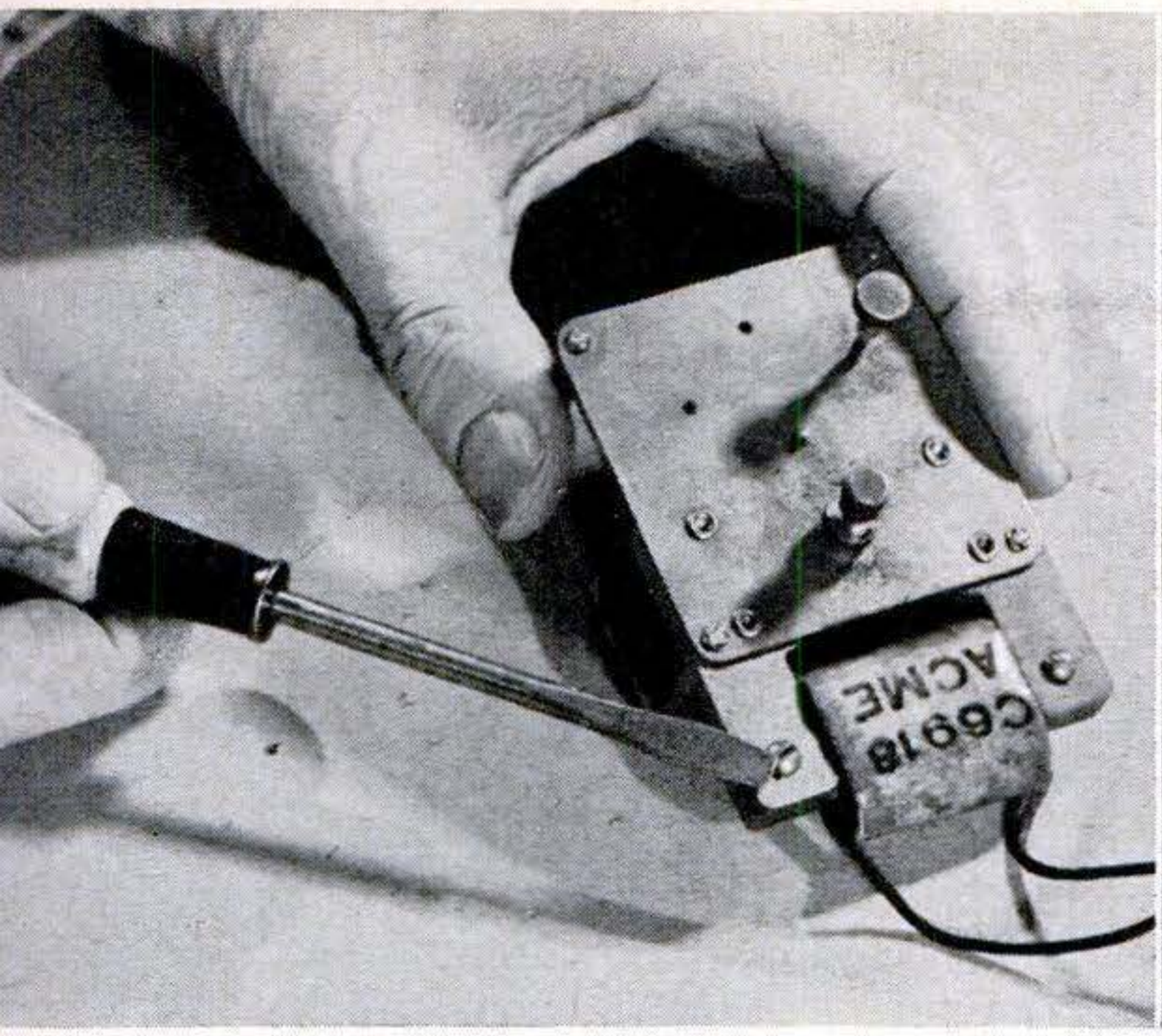
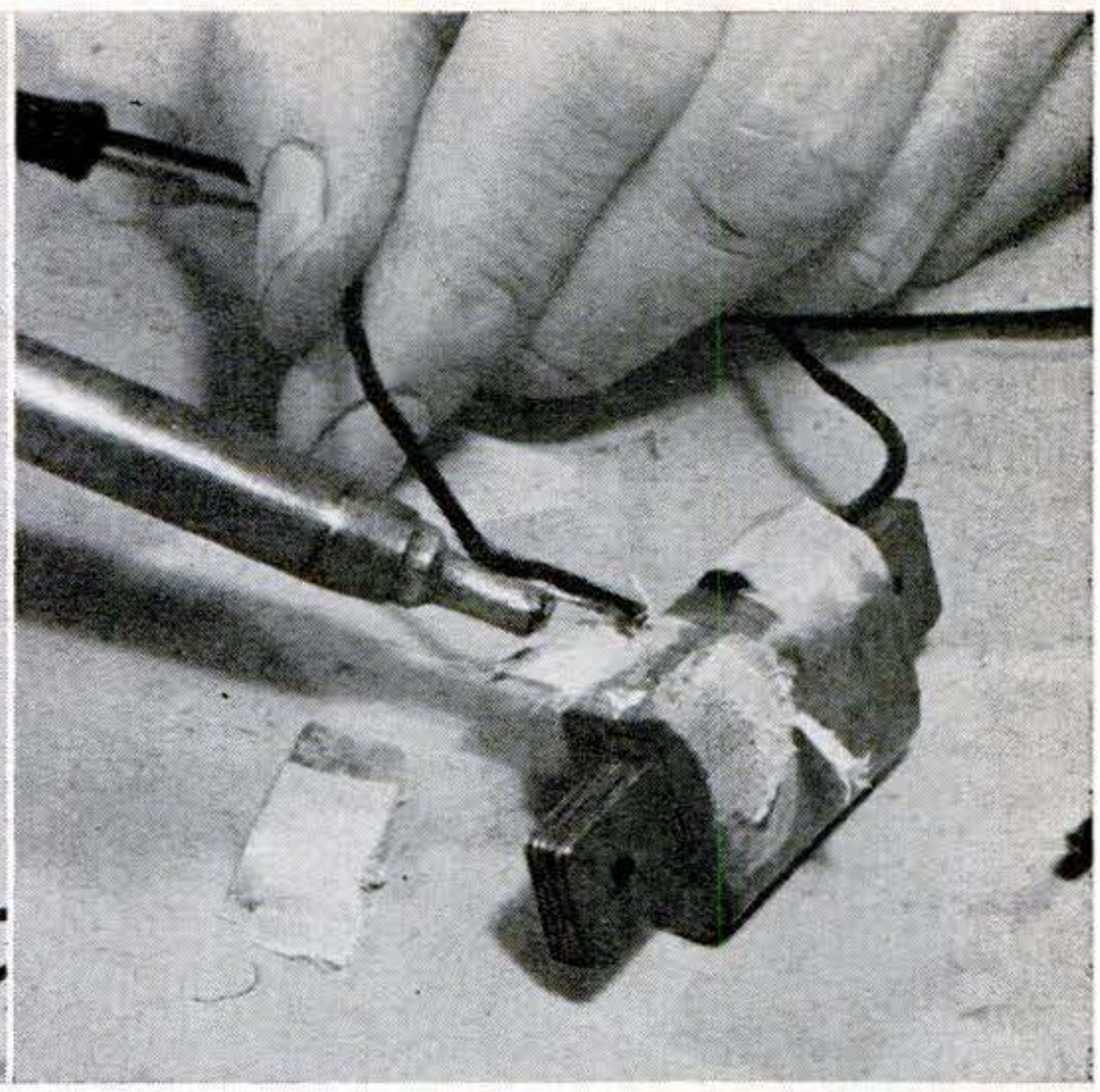
Electrical test is simple—repairs usually easy



IF IRON CORE IS MAGNETIZED when cord is plugged in, electrical part of clock is okay. To replace dead coil, remove screws at either end of core and slide the coil off one end.



DEAD COIL may be due to broken connection between pigtail lead and coil winding. Peel back first layer of insulation, scrape wires clean, and resolder. Restore insulation with shellac.

time, apply oil to another hole. Suction will draw oil into the gearcase. If this doesn't cure the trouble, unsolder the cover and clean and lubricate the works as previously described. Be careful to apply only enough heat to break the solder joint. Overheating may damage parts inside or vaporize the oil and cause it to ignite.

The crash victims. Probably more electric clocks meet an untimely end by being knocked off a night table than will ever die of old age. If, after cleaning out broken glass and straightening the hands, such a crash victim groans and grinds or refuses to run, chances are: 1) the main frame is sprung; 2) the gears are knocked out of mesh; 3) the rotor disk on a multiple-shaded-pole type is bent enough to rub on a pole piece.

Loosen all mounting screws a half-turn and gently work the frame back and forth. This will sometimes relieve minor strains that may have been set up by the jar. When the wheels turn freely, tighten the screws. (If the frame is badly sprung, save your time and buy a new clock.) Check gears for proper mesh, particularly the drive pinion on the rotor shaft. The motor may have shifted slightly. Readjust for proper mesh and tighten motor-mounting screws. Turn the rotor disk with your fingers to see if it binds. Bend the flange with tweezers or pry it gently with a small screwdriver if it touches a stationary part.

Electrical troubles. Aside from an incandescent light, an electric clock has about the simplest electrical parts of any device in your house. There is nothing electrical inside but a coil of insulated copper wire wound on an iron core. The two ends of the coil are connected to the two wires in the plug-in cord.

If, on your initial listening test, you heard no hum or murmur, it is likely that juice is not flowing through the coil. To make sure, hold a screwdriver blade almost touching the iron core if it's accessible, or the exposed rotor of a multiple-shaded-pole motor. If the coil is working, you'll feel and hear the blade vibrate. If you feel no pull, look for a break or bad connection where the cord connects to the coil, where it enters the clock case, or is attached to the plug.

Rarely will the break be in the coil itself. Occasionally a coil will burn out for no apparent reason. You can spot this by charred insulation and smell. External coils found in Telechron and phonic-wheel clocks are easily replaced. New coils cost from 75¢ to around $2. Check with the manufacturer of your clock if it is the multiple-shaded-pole type with an internal coil.

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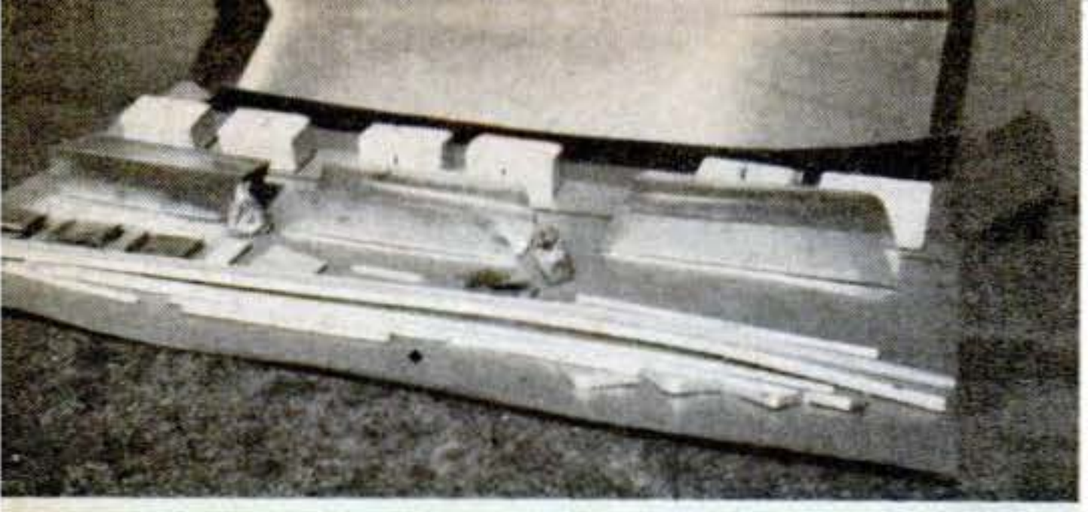
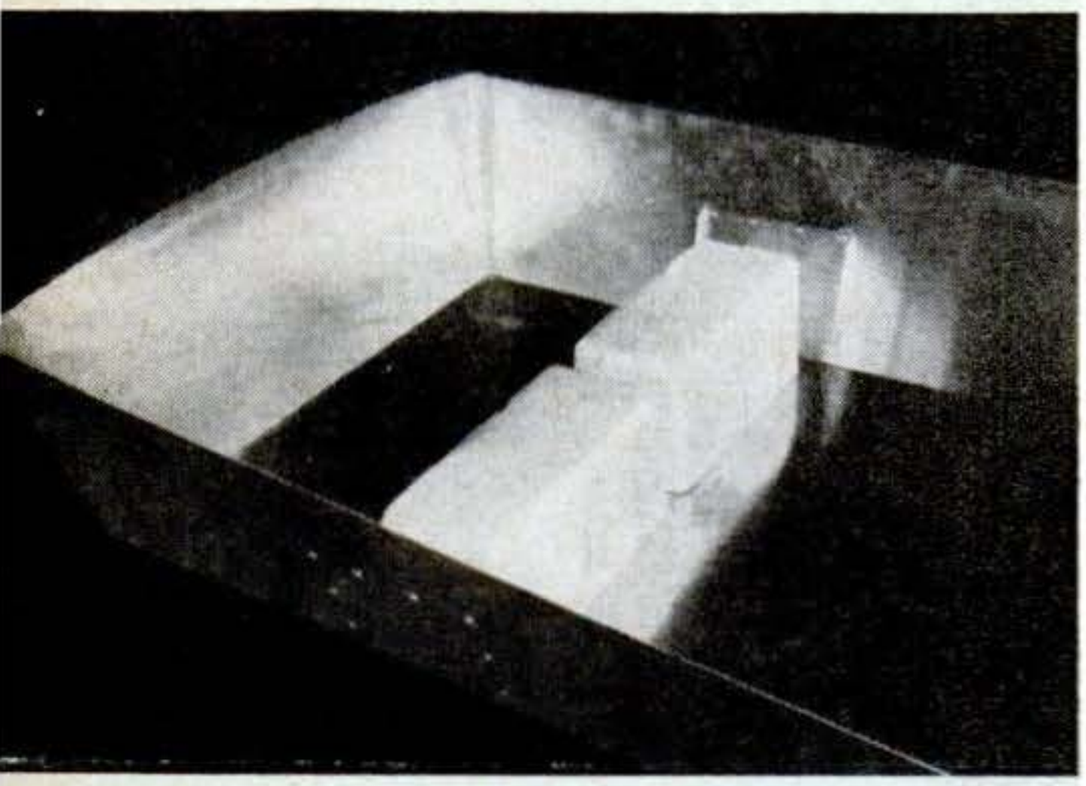


THIS IS A 12-FOOTER in bits and pieces as it comes from the factory. Note that some parts are preformed.



TWO FOAM FLOTATION BLOCKS go under each seat. This gives enough buoyancy to float boat, riders, and motor.

A GOOD TRAVELER, the finished 12-foot pram is easy to heft on and off a car roof. It weighs only 72 pounds.

HERE COME

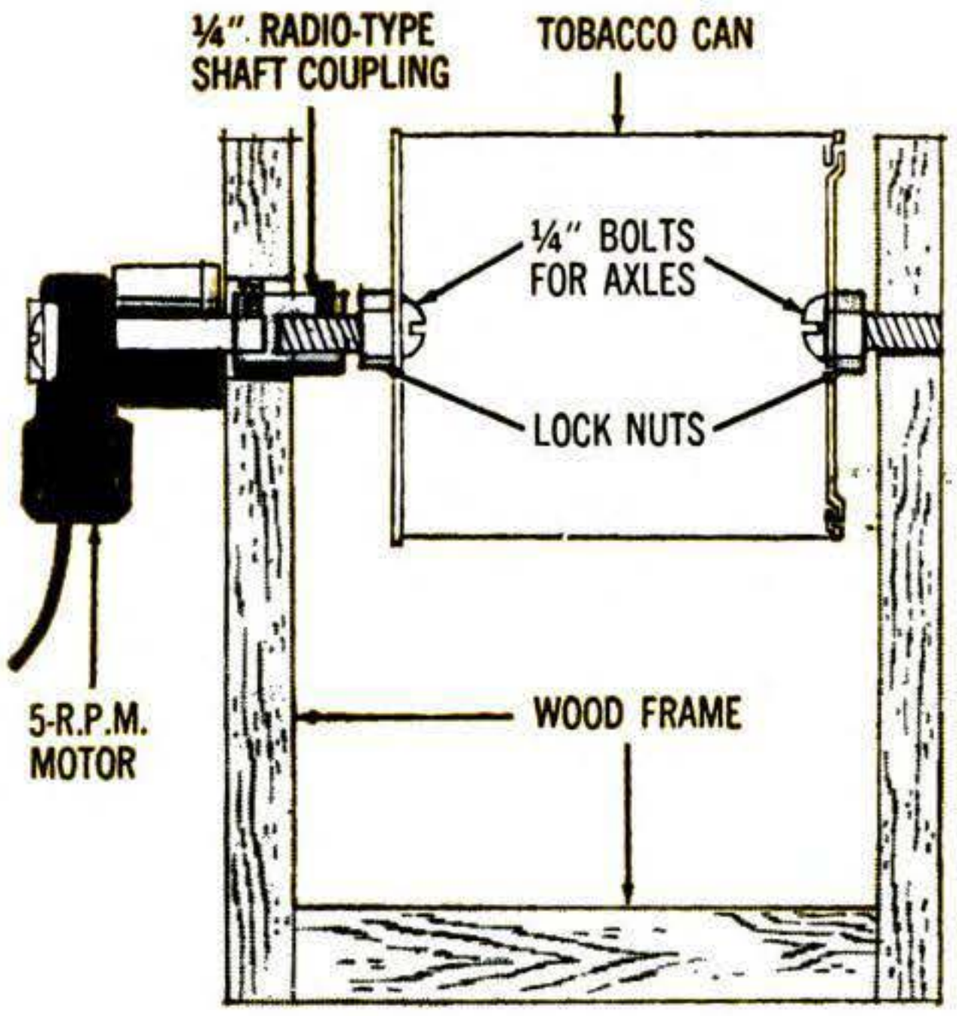
Aluminum Boats in Kits

NOW you can buy an aluminum boat as a kit. Your choice ranges through seven sizes and styles—from a 7- to a 14-footer, with either pram or pointed bow. The smallest weighs only 38 pounds, the largest about 85.

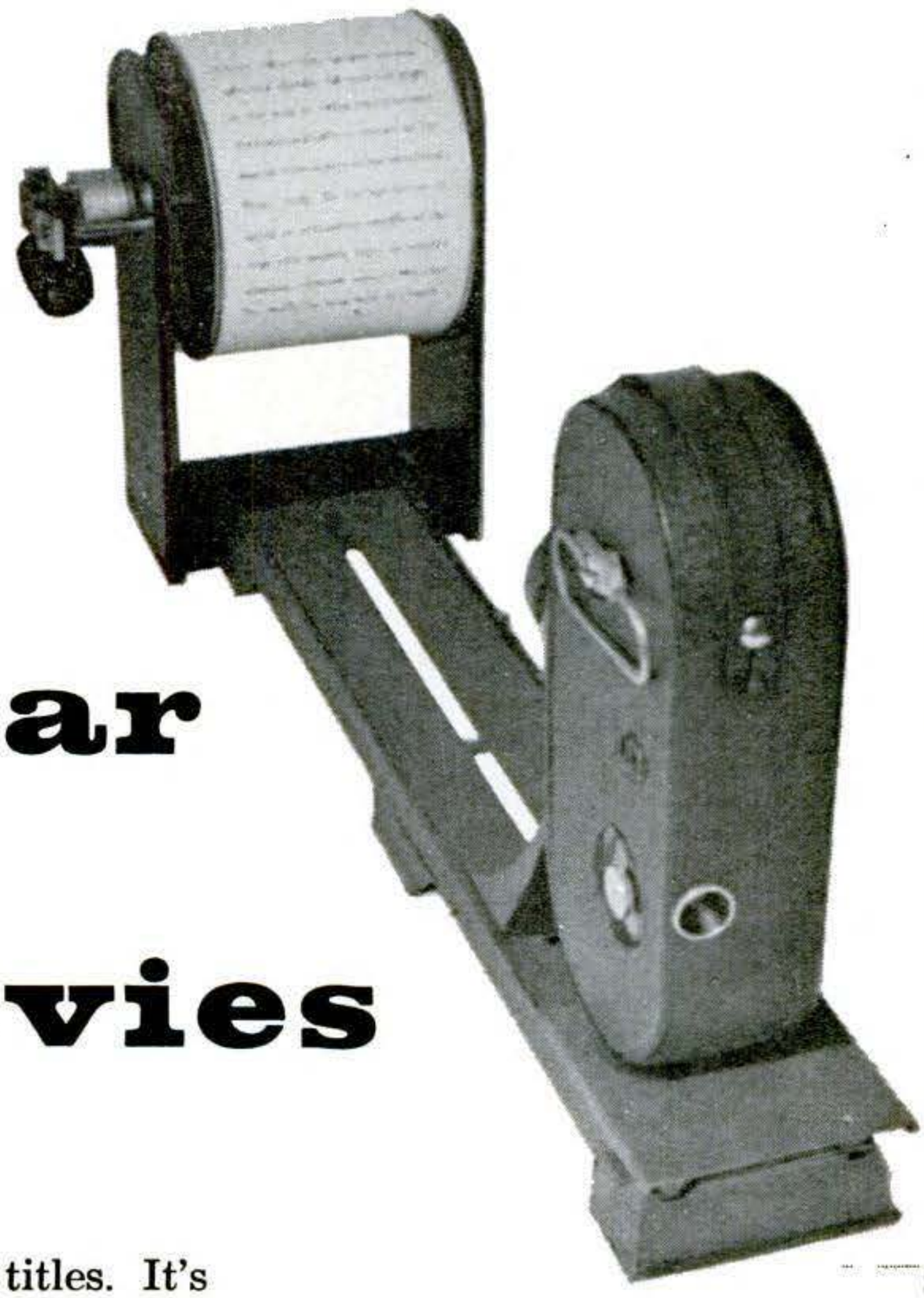
Each kit consists of a hull welded from .052″ sheet aluminum, preformed seats and mounting brackets, curved extruded aluminum gunwales, keel and transom brace, cast-aluminum corner brackets, and enough nuts, bolts, and metal screws to assemble the job.

Marine bedding compound is used on the through-hull fittings to prevent leaks. Pilot holes have been drilled in many pieces. Styrofoam blocks under the seats make the boat unsinkable. A drill, screwdriver, small wrench, and a couple of C clamps are the tools needed.

The 12-footer delivers anywhere in the U. S. for $127 or less. The kits are made by Alumakit Corp., Salem, Mass.—*G. P. Manning.*



WORDS ROLL MAGICALLY into view on this revolving drum. It's just an old tobacco or similar-size can driven by a tiny, slow-turning motor, as in the sketch at left.



Tiny electric motors drive . . .

Spectacular Titles for Home Movies

By James R. Oswald

GOOD home movies deserve exciting titles. It's surprisingly easy to add a professional flourish to your films if you make a few simple accessories. Many of the hand-cranked devices available run jerkily; you'd need six hands to operate them and the camera at the same time. The answer is to motorize them so they run smoothly without your attention.

Tiny, inexpensive electric motors are usually available in many types from large radio-supply houses and war-surplus outlets. For most special effects, you'll want the high-torque, slow-speed type that turn at three to five r.p.m. and have plenty of muscle for moving things. These are generally known as display or timing motors.

All of the devices shown here can be used with a standard movie titler that supports the camera and lights, or you can rig up your own support.

Spinning your titles is an effective trick. Titles mounted on a rotating disk start out as a whirling blur, then magically slow down and stop before you.

Since it's hard to stop a

CONTINUED

TITLES SPIN DIZZILY on this rotating disk and come to rest right-side-up. The trick: You start it upside down, run the film backwards. An old electric fan turns it. Blades are flattened and bolted to a wood disk to which cardboard circles are attached with peelable cement.

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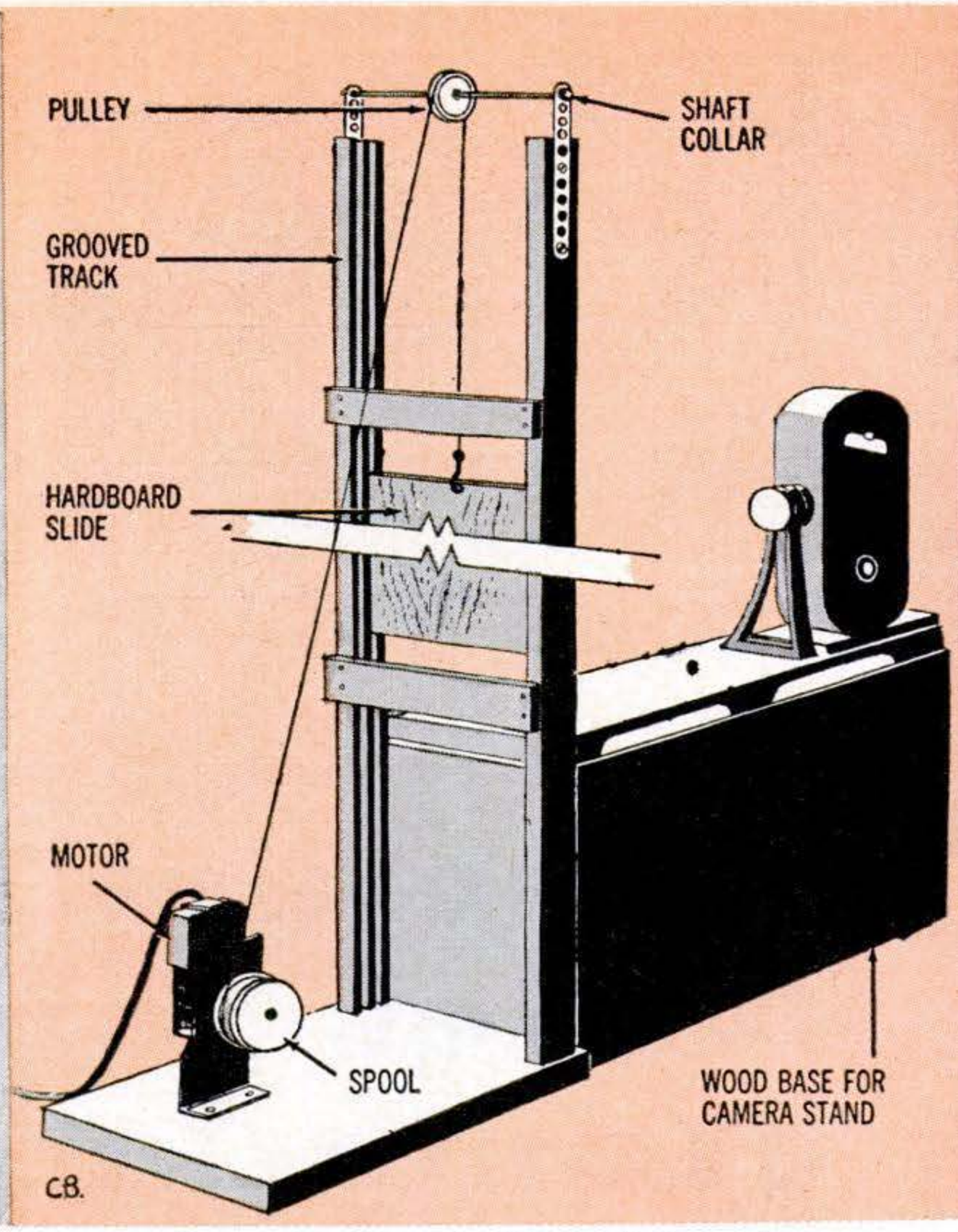

PROFESSIONAL-STYLE TITLES glide slowly past the camera on this elevator. The titles are printed on a hardboard slide that's hoisted upward in grooved tracks by a small motor.

spinning disk exactly where you want it, you use a special technique.

You start the filming with the disk in a stopped position and the title upside down, then run it up to full speed and stop the camera. To project the film, you turn it end for end and run it backwards so the title stops spinning and comes to rest right-side-up.

On single-sprocket film, it's necessary to reverse the sequence from left to right as well as end for end so that the sprocket holes will line up right. To allow for this, the title must be laid out to read backwards as well as upside down when you film it.

The whirling trick. For a fast-spinning title, you can use an old electric fan, as shown here, or any small household motor. Another version of the whirling trick is to rotate a colorful background while the title itself remains stationary. In this case, you don't want the disk to become blurred, so you use a slow-speed motor—one that goes no faster than about four to five r.p.m.

Cardboard disks with spirals and other patterns painted on them can be mounted on the motor shaft with hubs made from plastic or hard-rubber bottle stoppers. Drill the hubs for a press fit on the shaft so the disks can be removed and interchanged easily. Cement the hubs to the cardboard disks.

Titles can be superimposed over a spinning background either by exposing the film twice—once for the background and once for the title—or by printing the titles on glass or clear plastic and holding them up in front of the background. One popular stunt is to arrange the letters of the title loosely on a sheet of glass suspended flat over the spinning disk. The letters are then blown off the glass while the camera grinds away. When this sequence is run backwards, the scattered letters appear to fly out of nowhere and arrange themselves neatly in the proper order.

Titles that roll. The old Hollywood practice of making titles roll up the screen before your eyes can be duplicated

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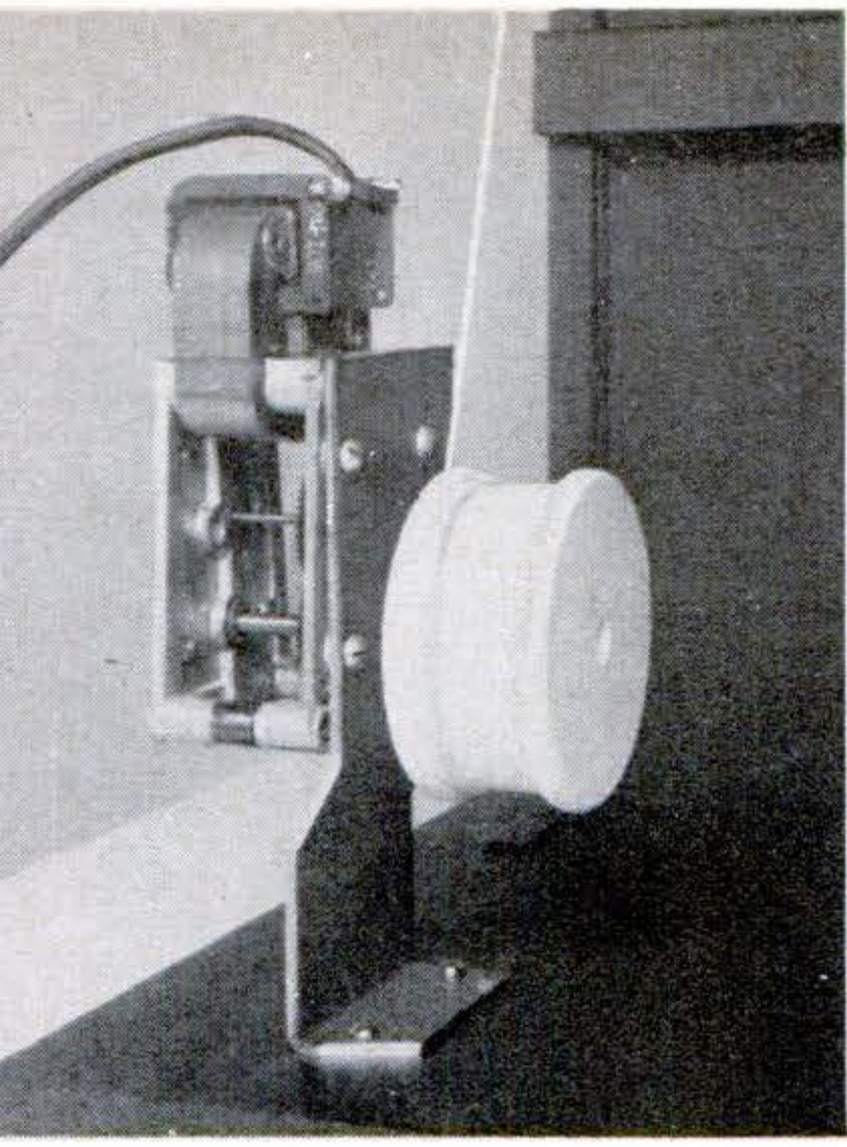
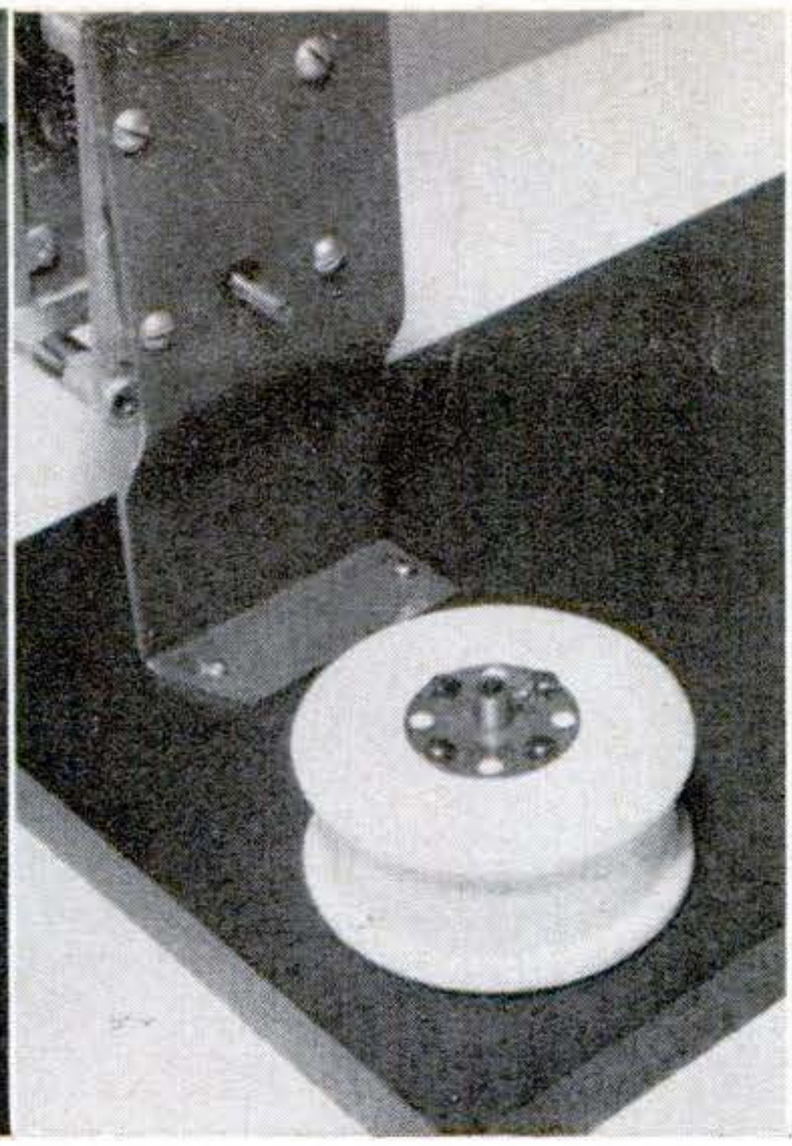
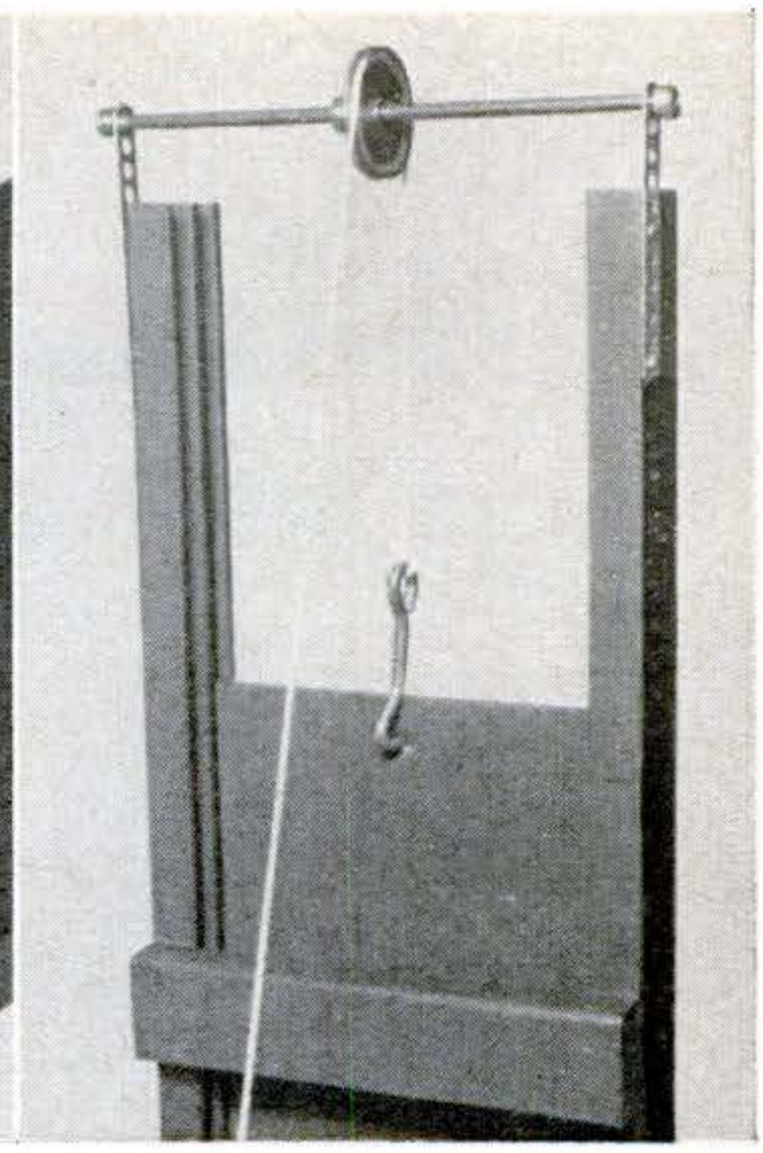


MINIATURE HOIST to pull the slide up is made of an old fishing-line spool attached to a slow-speed, high-torque motor.



SPOOL IS MOUNTED on the motor shaft with a metal hub from a toy construction set. It could also be drilled and cemented on.



PULLEY WHEEL and brackets for top of hoist are also from a toy construction set, but any type of flanged pulley will do.

by the home movie maker in two ways.

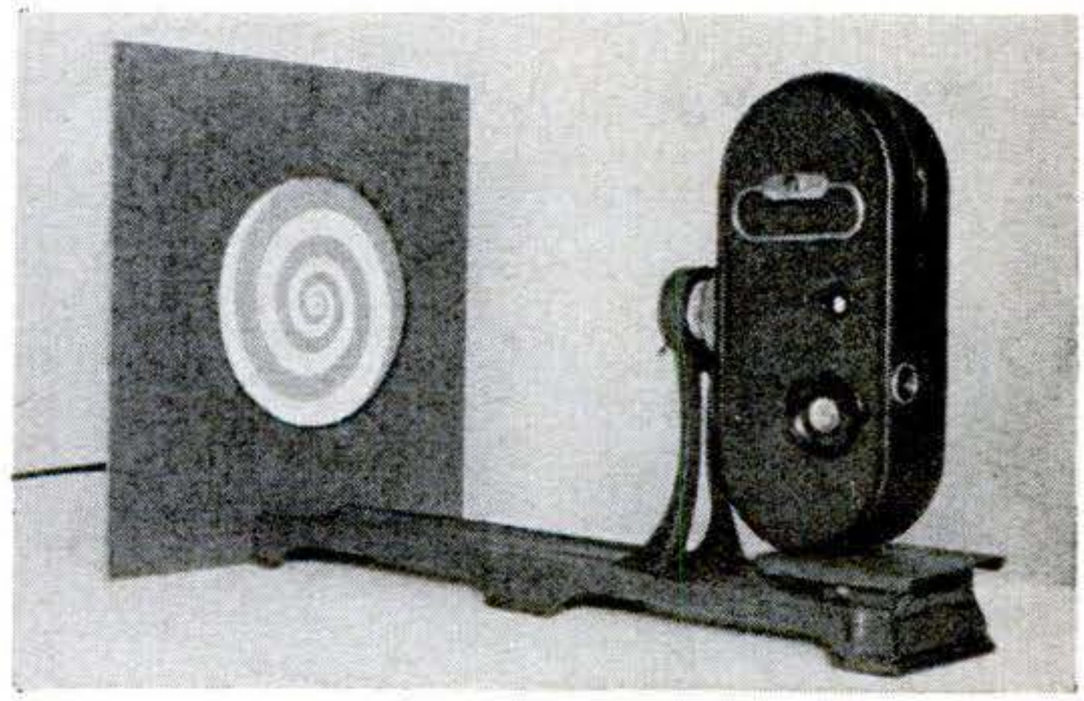
Long titles or descriptions of scenes can be typed on strips of paper and cemented to a revolving drum made from a large tin can. Two ¼″ bolts through the ends of the can form axles to support the can in a wood frame. A tiny motor, coupled to one axle, turns the drum at a slow, steady four r.p.m.

For lists of short titles, credits, and place names that you want to show in large, fancy letters, make an elevator device like the one here. The titles are printed on a long strip of hardboard and are pulled slowly upward past the camera lens in grooved tracks.

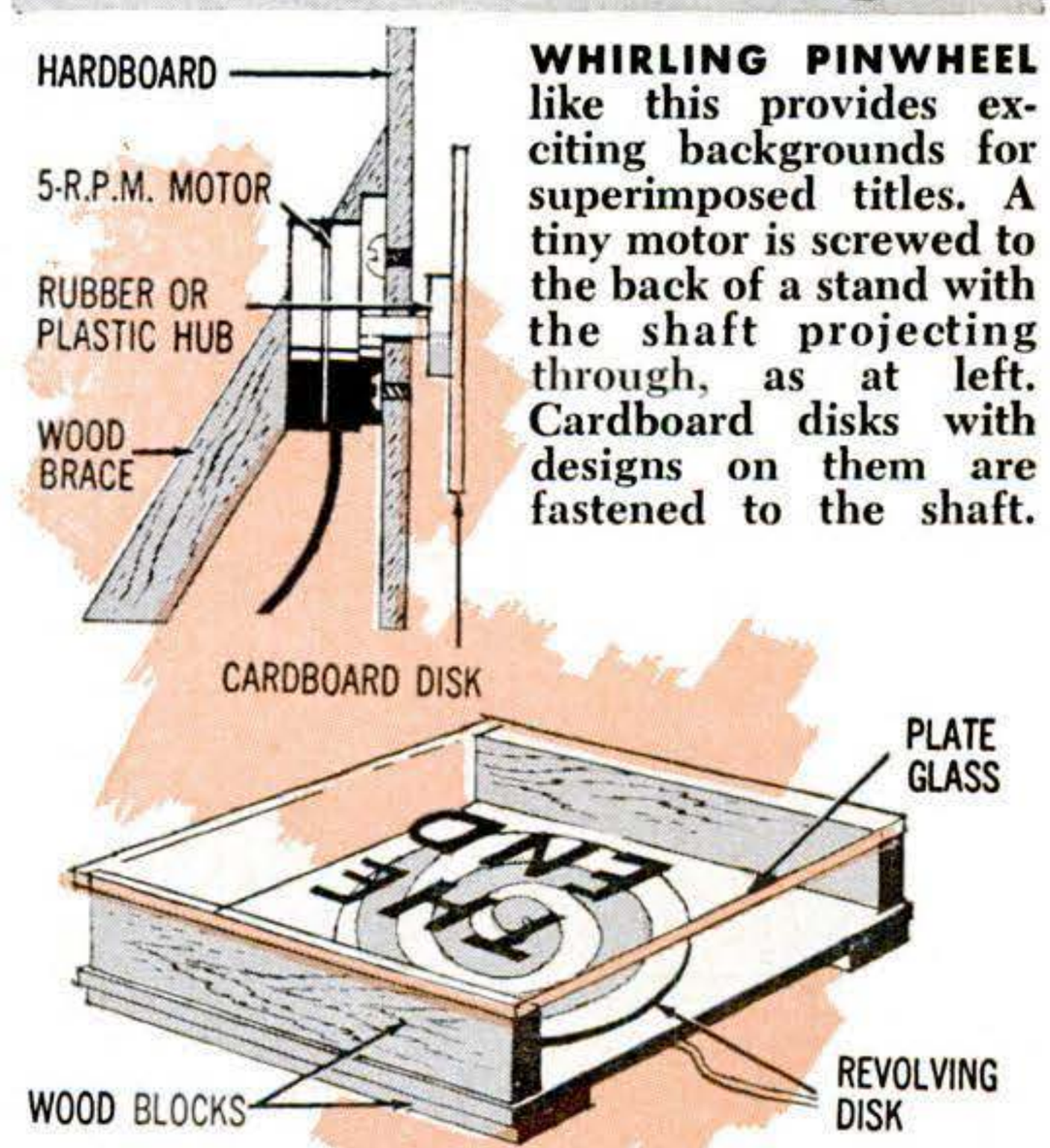
The tracks can either be homemade by grooving wood strips on a saw, or you can buy them ready-made, as here, in the form of guides for use on sliding-door cabinets.

A small, high-torque motor, fixed to a bracket behind the tracks, pulls up the hardboard slide by winding a cord around a spool fastened on the shaft. The slide can be made as tall as you need and can be quickly slid out and replaced with other slides.

The motors come with various types of mounting arrangements that may or may not suit your particular needs. Where they don't, special brackets can be fashioned from angle irons or heavy sheet metal.



WHIRLING PINWHEEL like this provides exciting backgrounds for superimposed titles. A tiny motor is screwed to the back of a stand with the shaft projecting through, as at left. Cardboard disks with designs on them are fastened to the shaft.



USING THE DISK FLAT lets you lay out titles on a sheet of glass supported above it so that both are photographed simultaneously.

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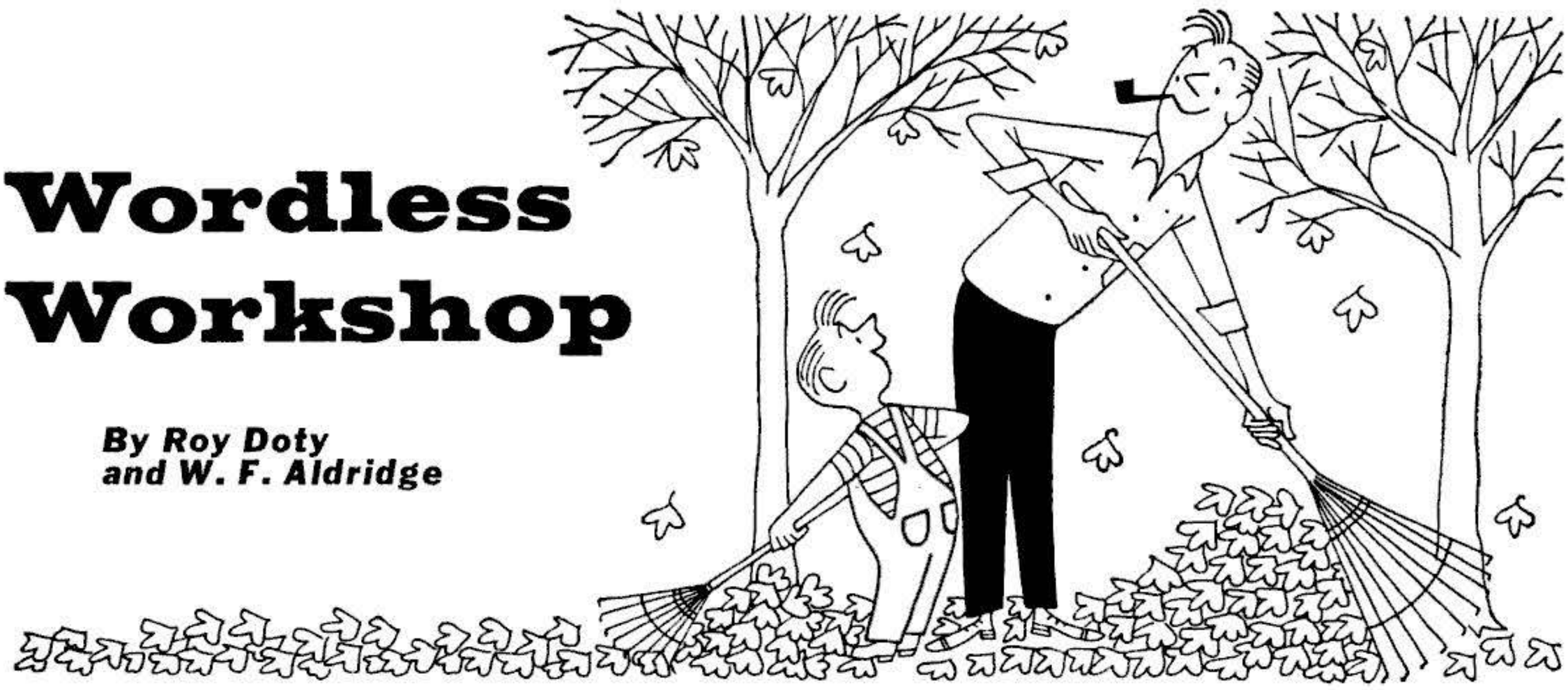
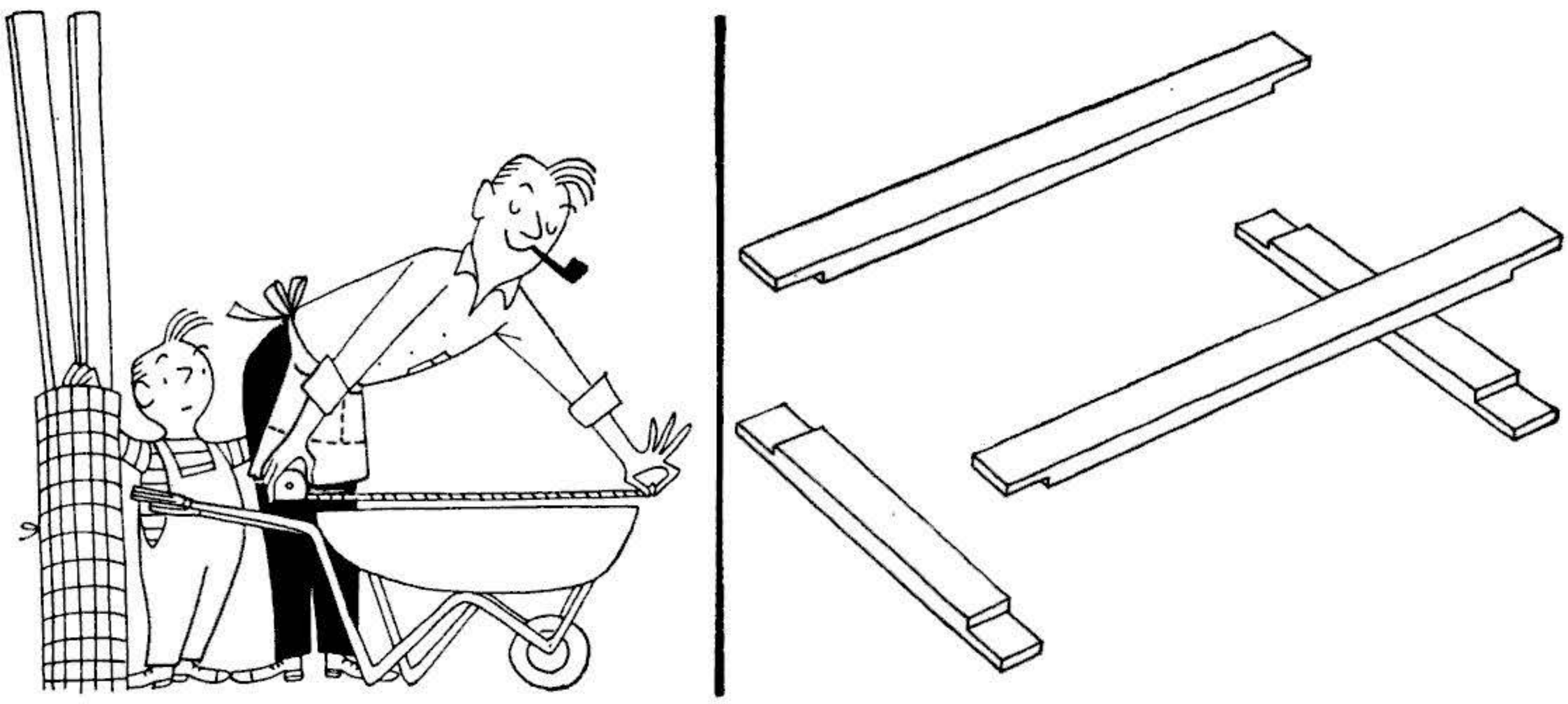
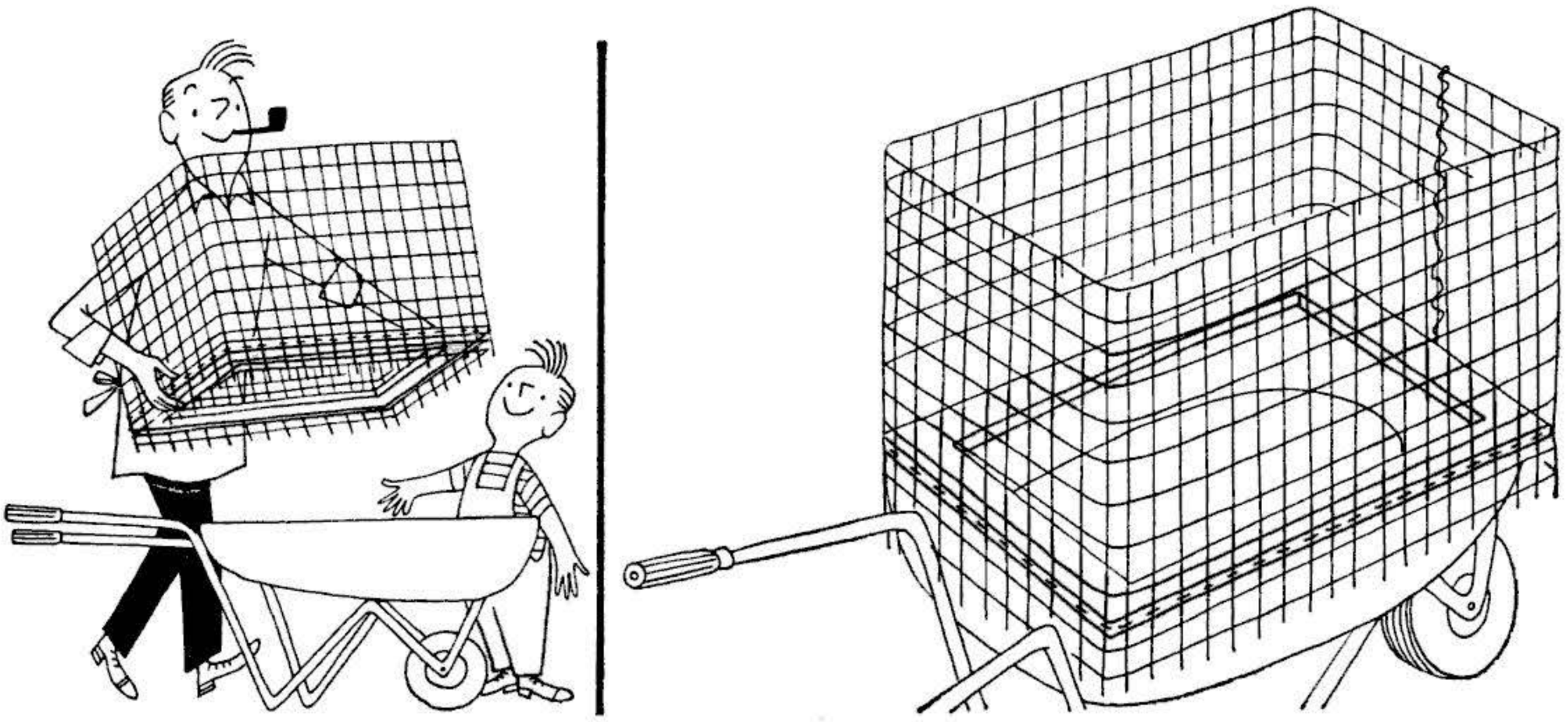
Wordless Workshop

By Roy Doty
and W. F. Aldridge







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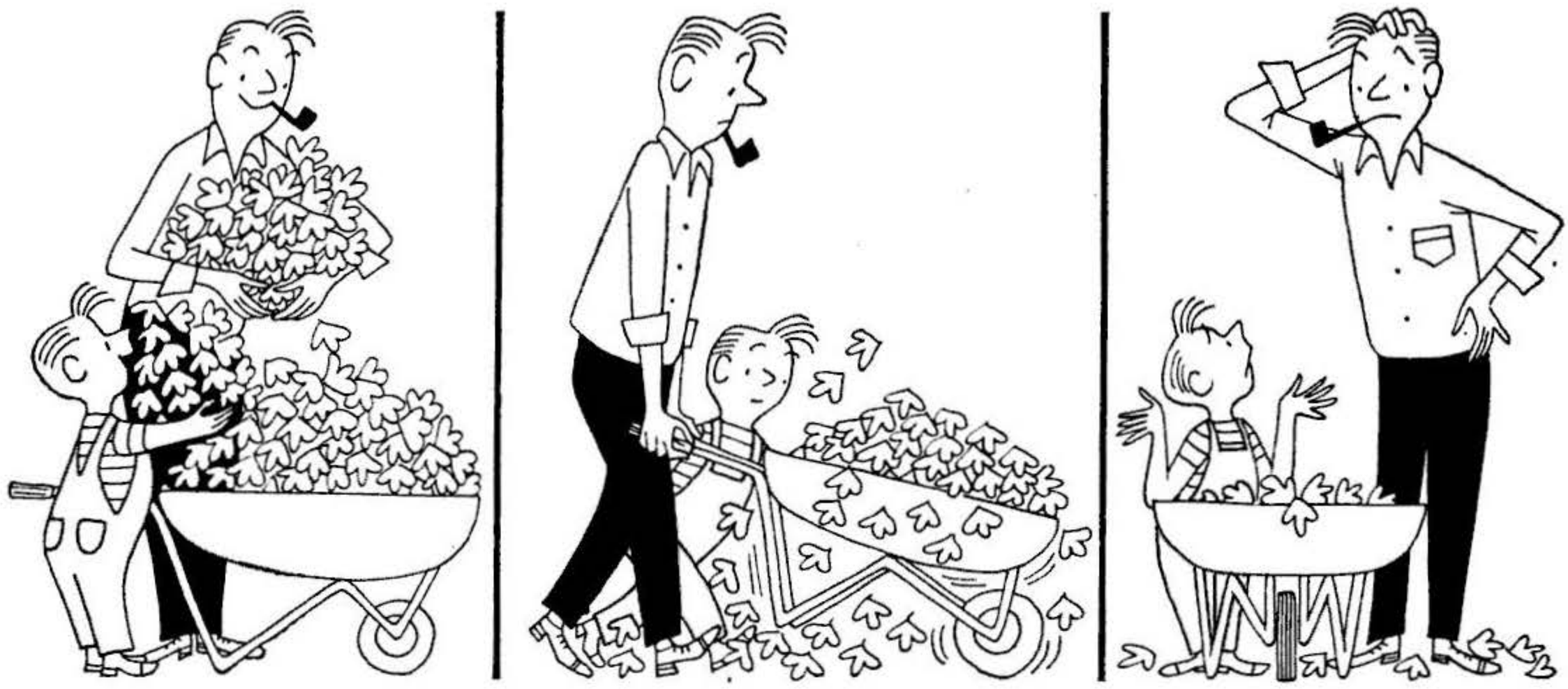

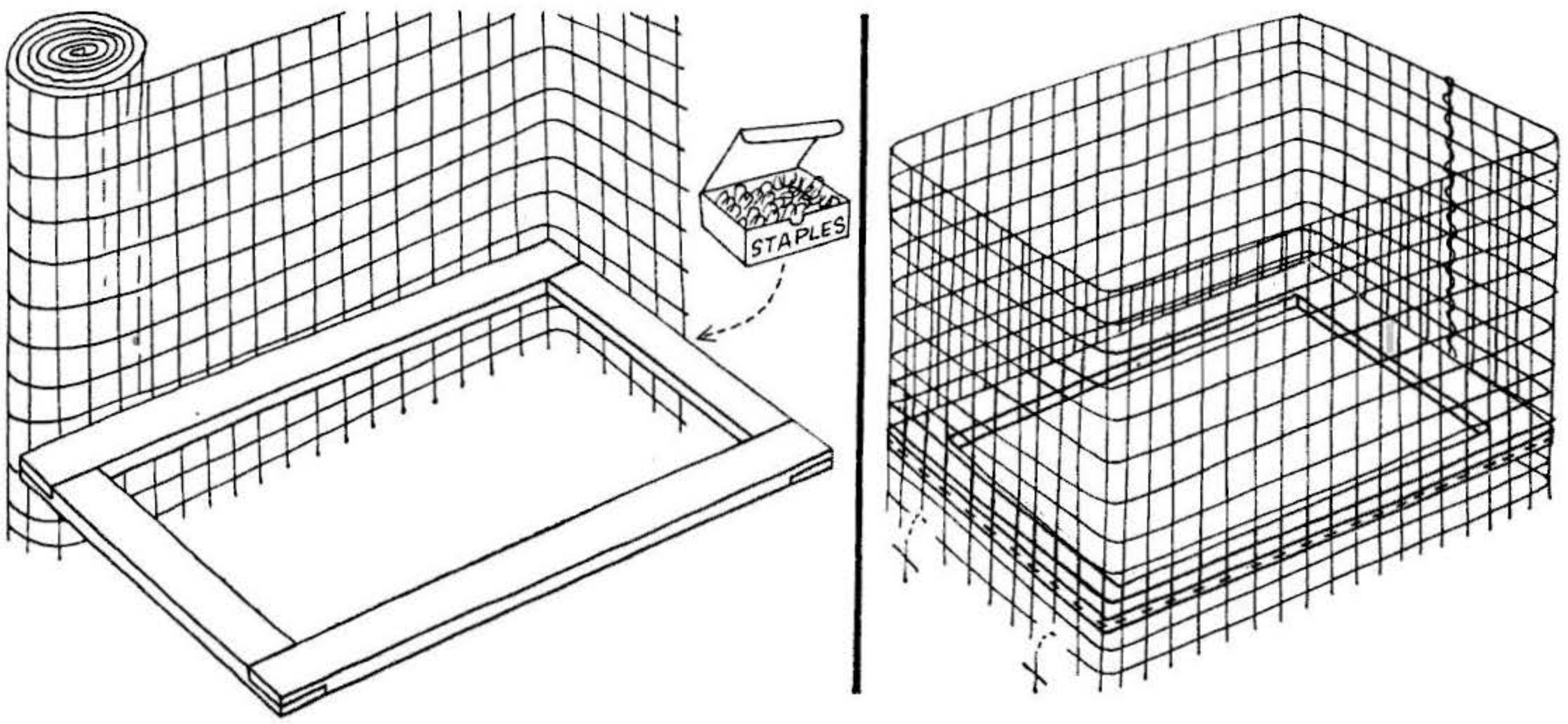

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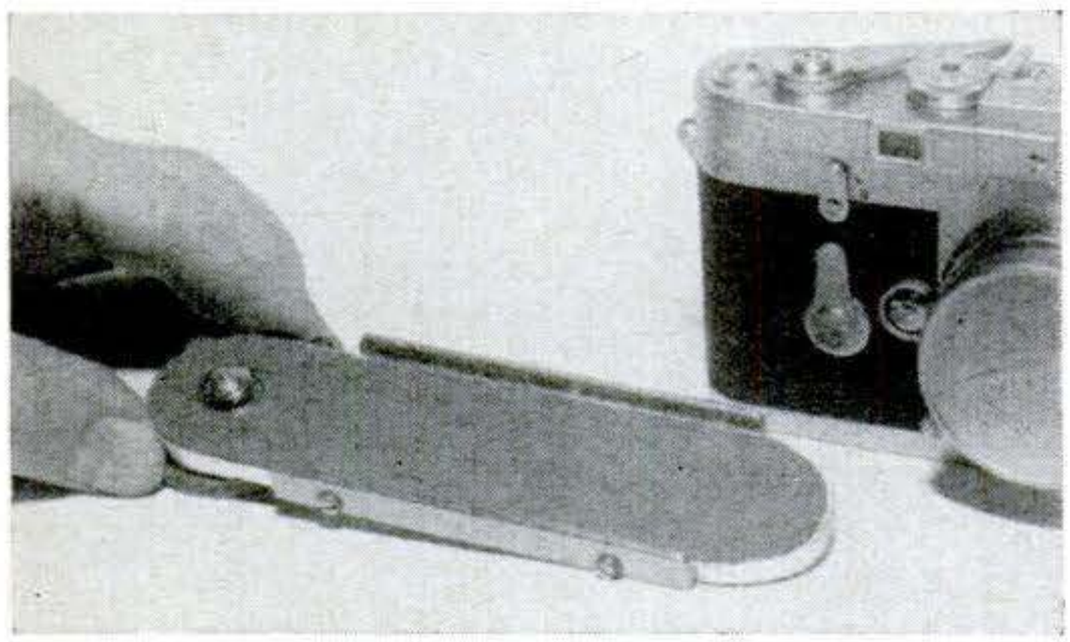
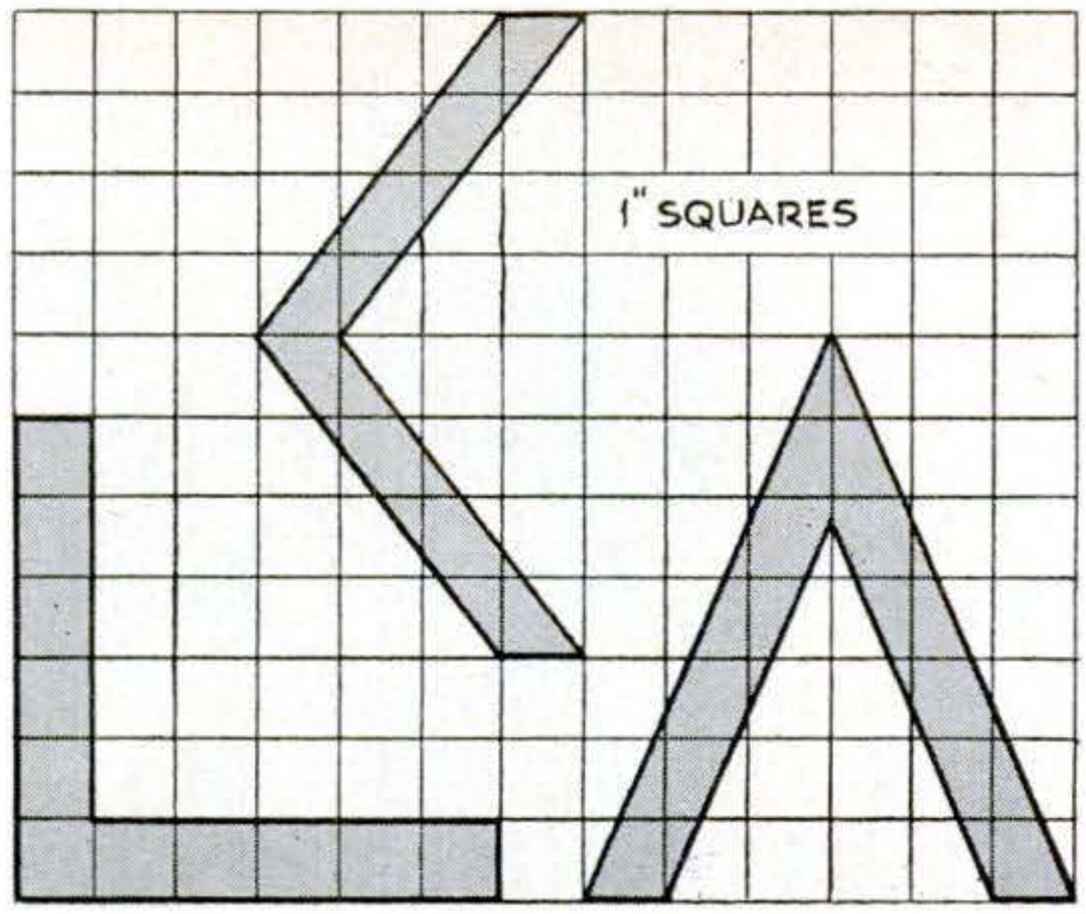
Centering a Camera on a Tripod

OFF-BALANCE MOUNTING results when a 35-mm. camera has its tripod socket far at the end. Camera tends to swivel when you make lens and shutter adjustments. A new socket is needed.



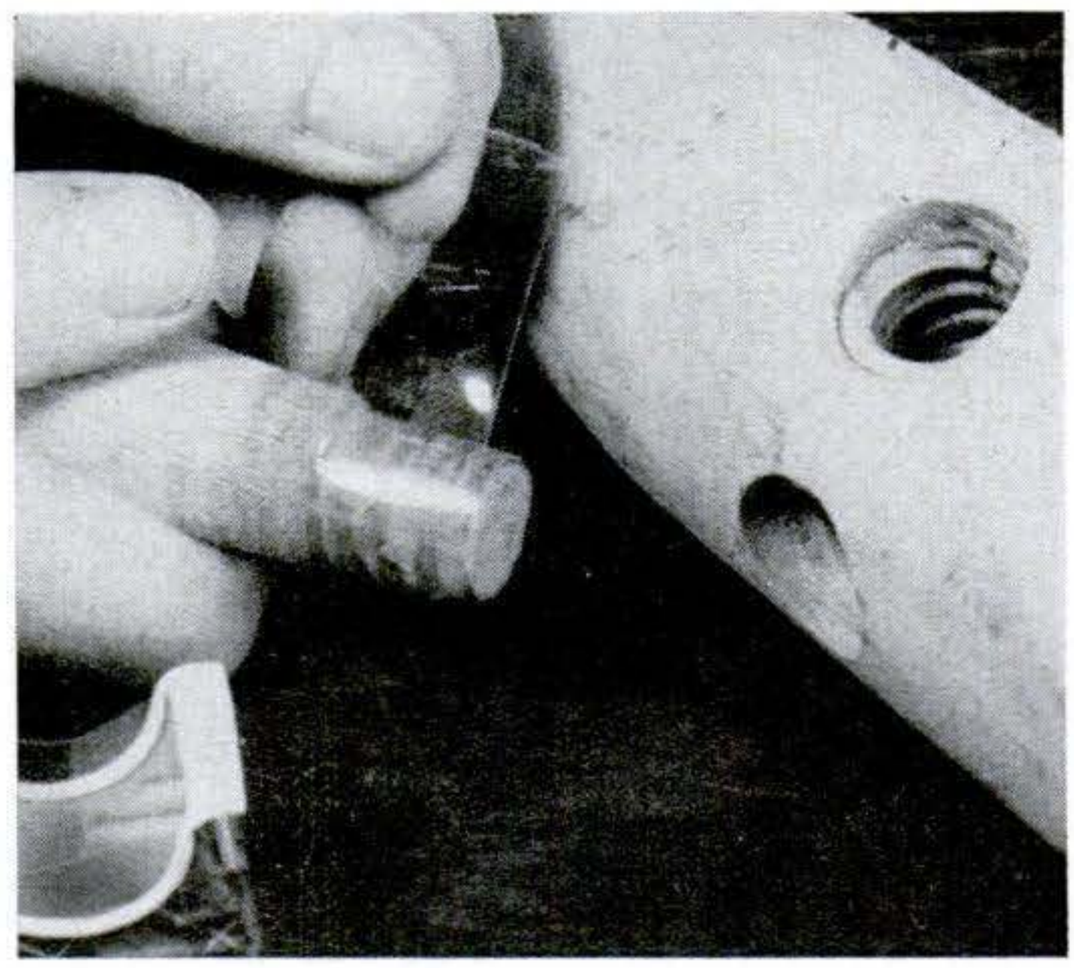
BASEPLATE TO FIT CAMERA can be cut from ¼" aluminum. Drill hole for knurled thumbscrew at one end and attach flanges to both sides. Face top surface with felt or thick blotting paper.

BALANCED MOUNTING is achieved by drilling and tapping a center socket for the tripod screw. Attach camera by turning thumbscrew into old socket.—*Robert Hertzberg, Douglaston, N. Y.*



Boomerangs from Cardboard

LAY out these boomerangs on thin cardboard—such as that inserted in a new shirt. After cutting, give a slight opposite twist to the arms. Lay one on your open palm and flick it sharply into the air with the forefinger of the other hand. Once you've acquired skill in launching, the boomerang will soar into the air, circle, and, return to your hand.—*Basil Jackson, Downsview, Ontario.*



Loose-Handle Repair

ARE the threads on your screw-in mop or broom handle too worn for a tight fit? Bind them with cellophane tape before turning the handle into its socket.

▶▶▶As A "finish" carpenter, I've found that a half-and-half mixture of kerosene and regular machine oil is a good lubricant for my oil stone or balky handsaw. I clean out old squeeze-type plastic glue bottles for use as lubricant dispensers.—*Edgar Blinston, Murray, Utah.*

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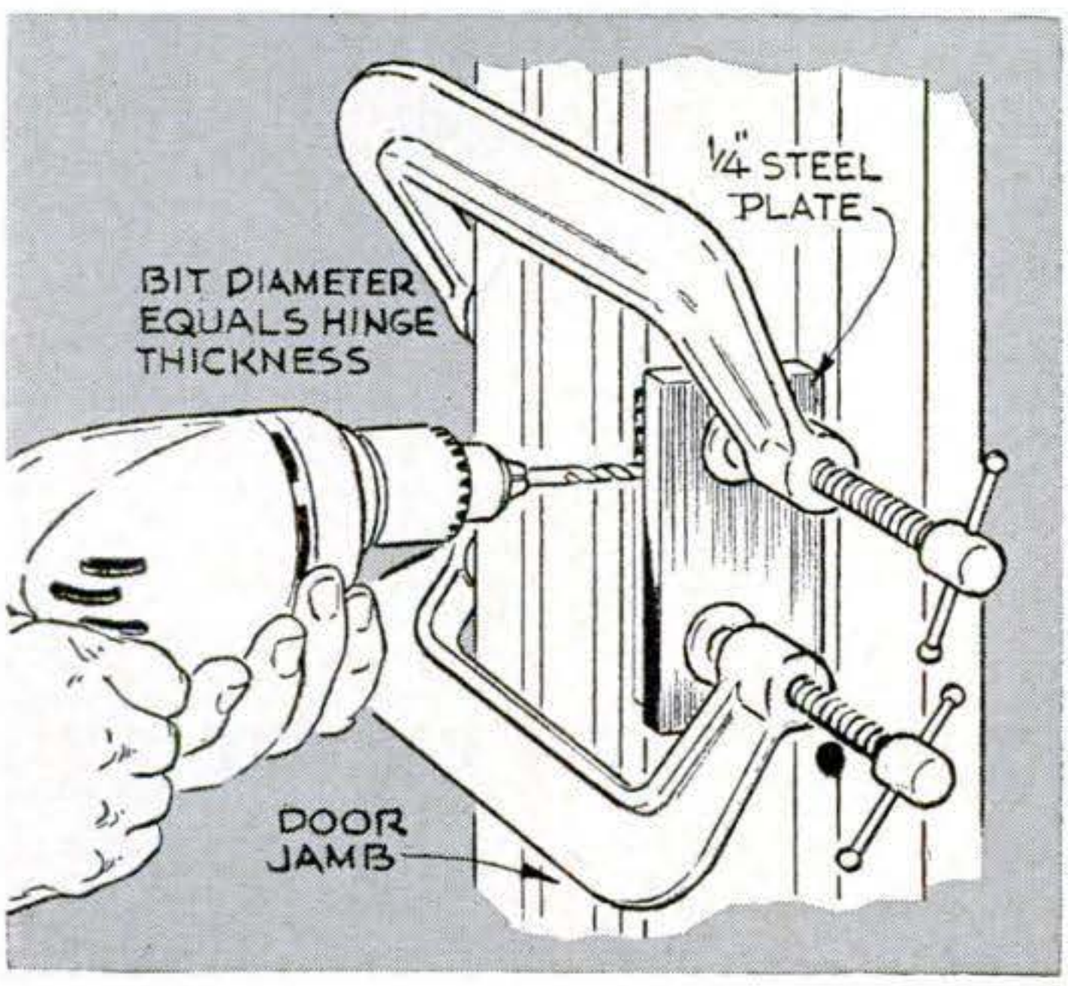
Short Cuts and Tips

FROM PS READERS

Keeping Tomatoes from Freezing

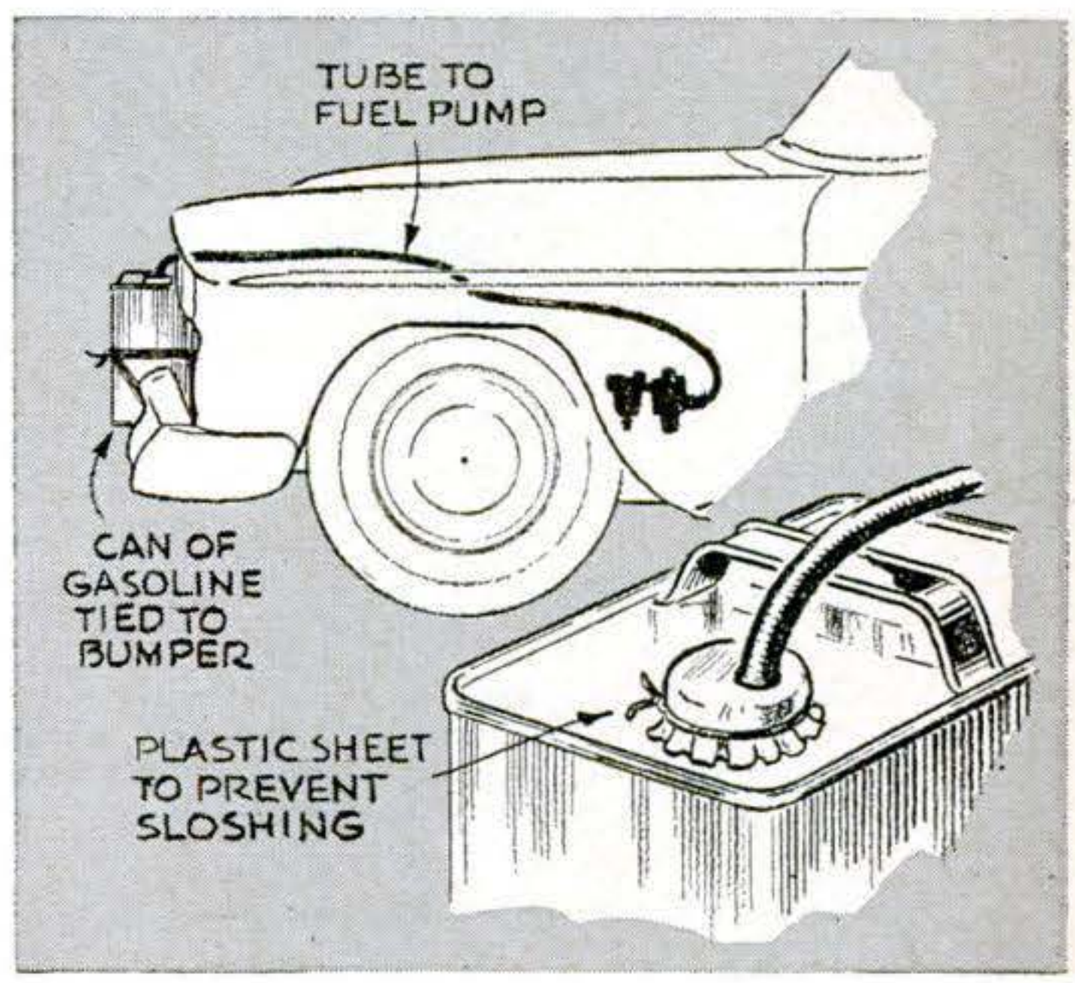
THE arrival of freezing weather each fall always ruins a lot of almost-ripe tomatoes in a garden. You can prevent this by piling straw or hay closely around the plants. This will allow the tomatoes to ripen. Open the covering a bit when you want to pick them.—*John Krill, North Lima, Ohio.*

▶▶▶YOU don't have to make a special trip downtown if you need a postal card in a hurry. Cut your own from thin cardboard. The standard 3¢ size is $3\frac{5}{16}''$ by $5\frac{9}{16}''$.



Mortising with a Drill

MORTISES must sometimes be located where cutting is difficult because of knots or the danger of splitting. You can do most of the work with a drill if you have a bit with a diameter equal to the thickness of the folded hinge. Clamp a steel plate to the inside of the jamb and keep the bit pressed against it while you drill a series of holes as deep as the width of the leaves. Remove the guide and clean up the mortise with a chisel.—*Stephen Stresnic, Ft. Lauderdale, Fla.*



Emergency Gas Supply

LAST January we drove over the unfinished Inter-American Highway to Guatemala. Even in a truck-camper, it's pretty rugged—50 miles to the first town beyond Mexico. In this stretch, the gas line broke loose at the tank.

On-the-spot repair was impossible. So I detached the flex line at the fuel pump and substituted a length of rubber tubing fed past the radiator to siphon gas from a reserve can, as in the sketch above. —*Franklin Davis, Santa Ana, Calif.*

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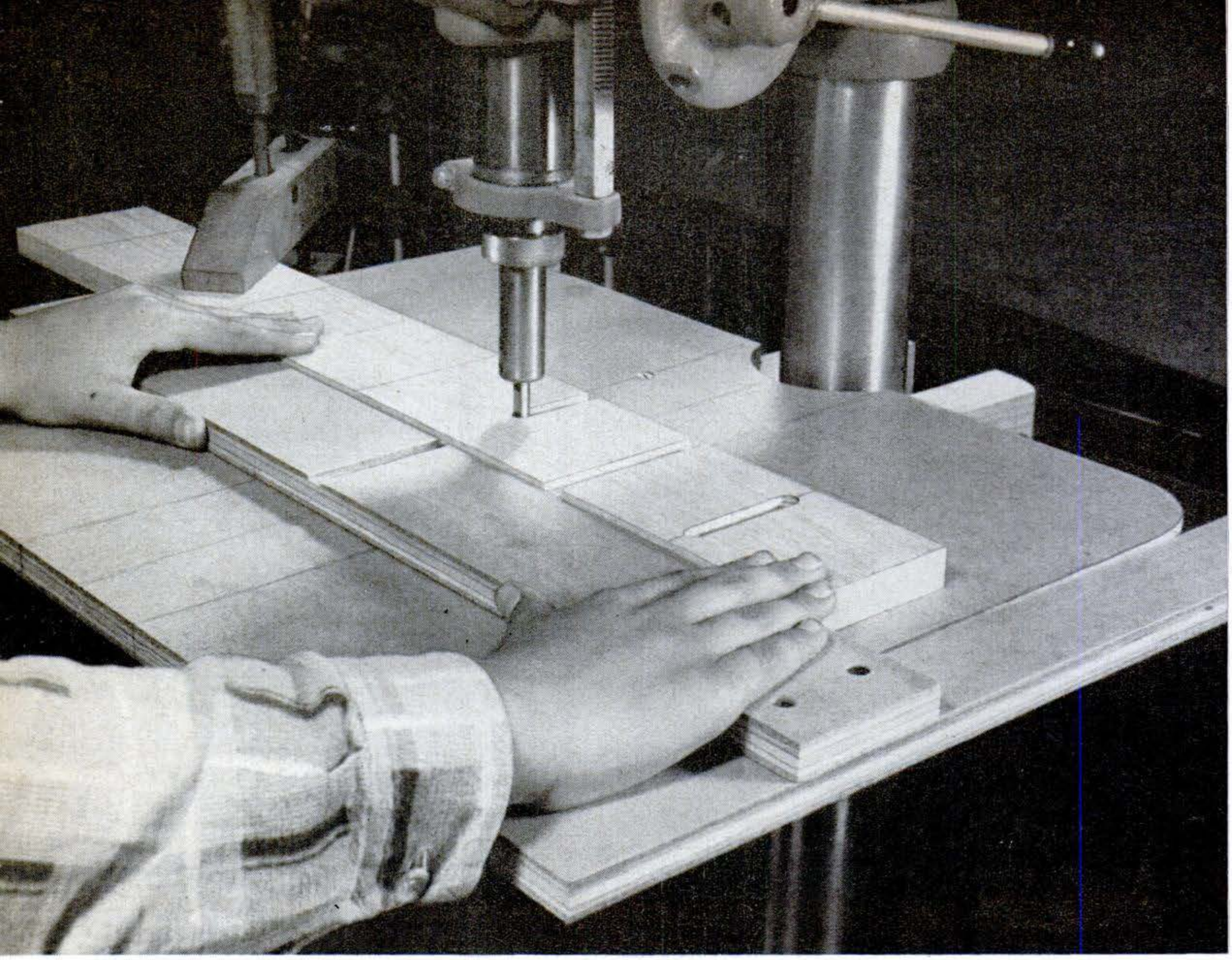

THIS SLIDING FENCE lets you feed the work straight into the cutter, making it easy to cut full or blind dadoes. To insure a straight cut, clamp the work to one of the fence guides, as at upper left; it won't shift under the cutter's side thrust. The fence can be made to fit either a homemade table, as here, or a commercial shaper table attached to the drill press.

A few accessories put your old tools to work on new jobs

Tips on Routing

By R. J. De Cristoforo

USING a drill press just for drilling is like owning a convertible without ever putting the top down—you're wasting half the joy. Add a few inexpensive router bits to your drill press and you can turn it into a remarkable machine that will do fancy jobs you may never have dreamed of.

Suppose you're building a drum table and need a circular groove in the top for an inlay. You can cut it by simply rotating the top under a router bit chucked in your drill press. You can do jobs not possible on any saw, such as cutting mortises and blind dadoes. If you want some intricate scrolls, a router bit will cut them faster and more smoothly than even a jigsaw.

Unlike drill bits, router bits have a special ability to cut sideways. When you lock a bit in the down position and push the work into it, it cuts a groove that matches the shape of its blades. Many varieties of straight and shaped cutters are available. Straight-bladed bits are the most common because they produce straight-sided grooves, slots, rabbets, and dadoes of various widths. You

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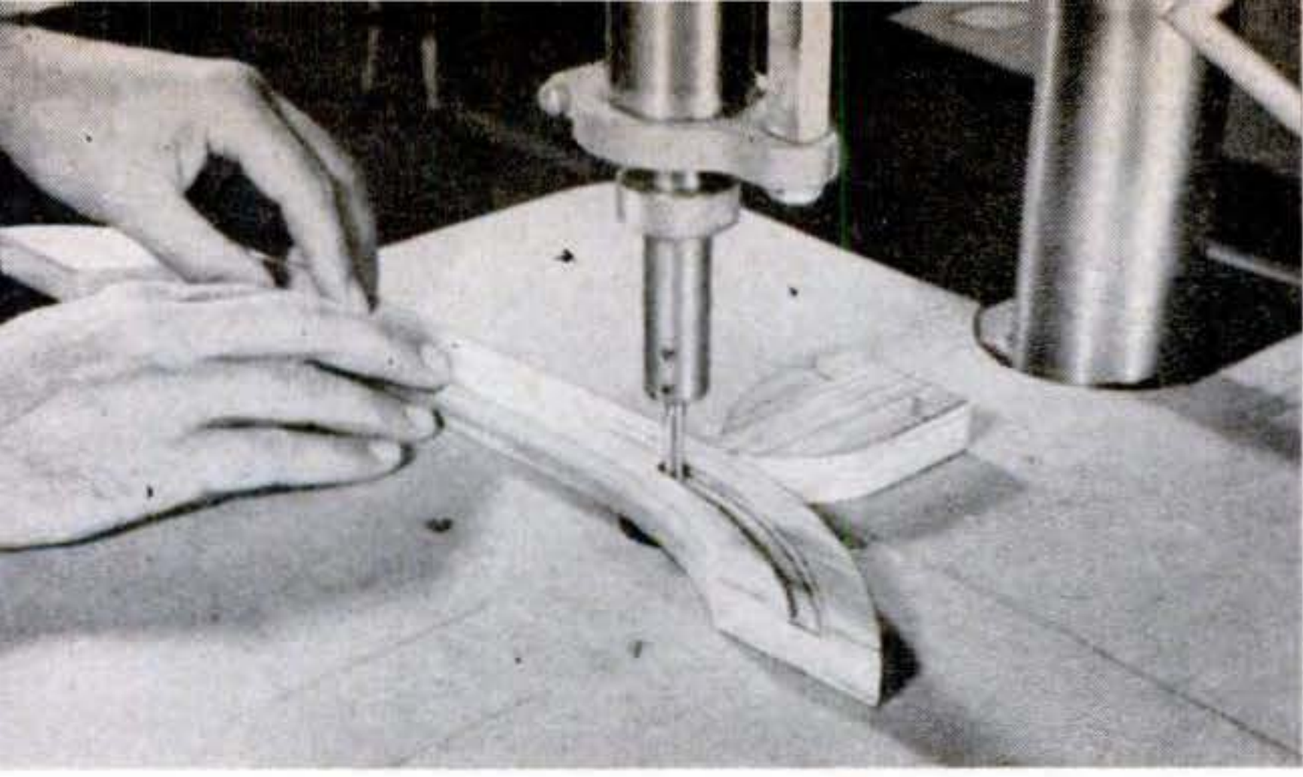
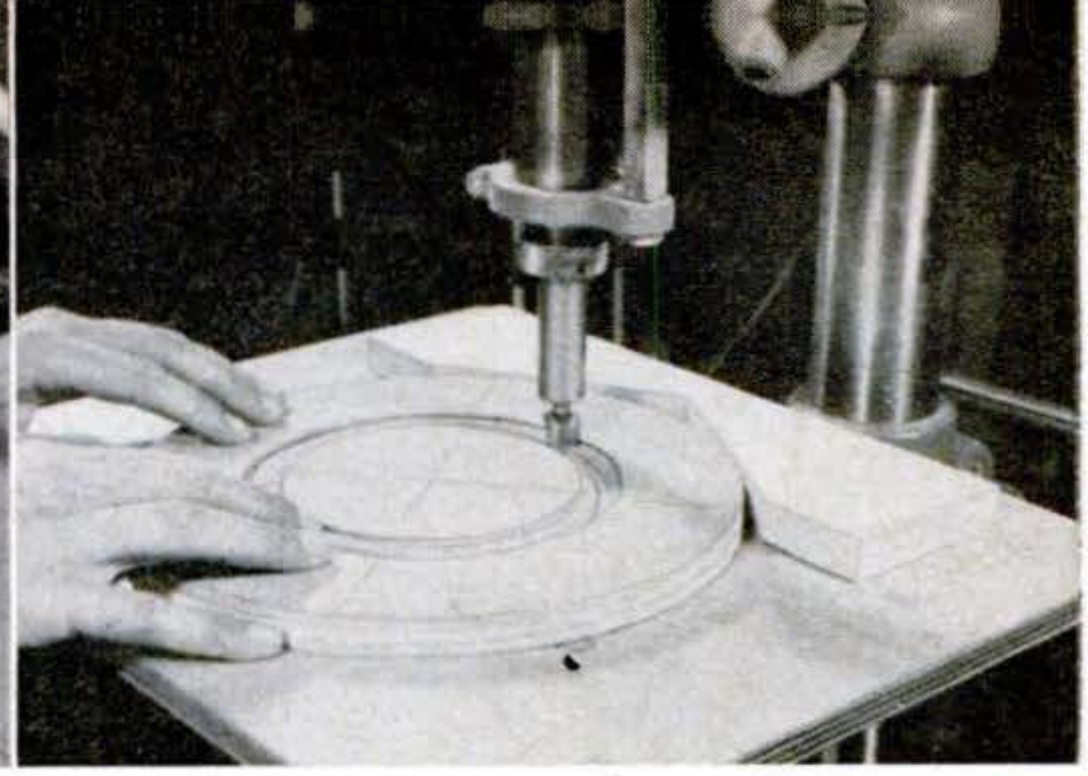
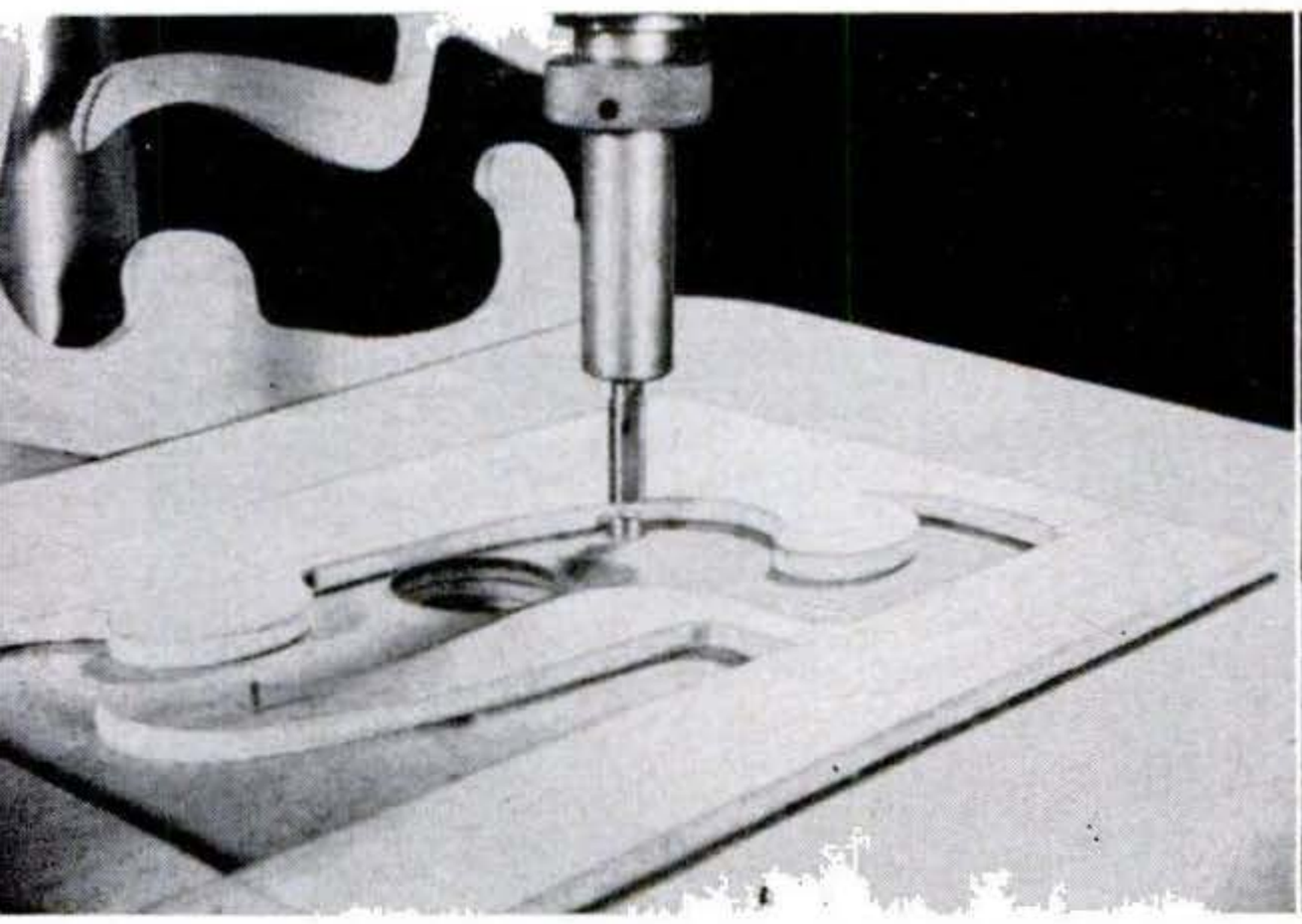


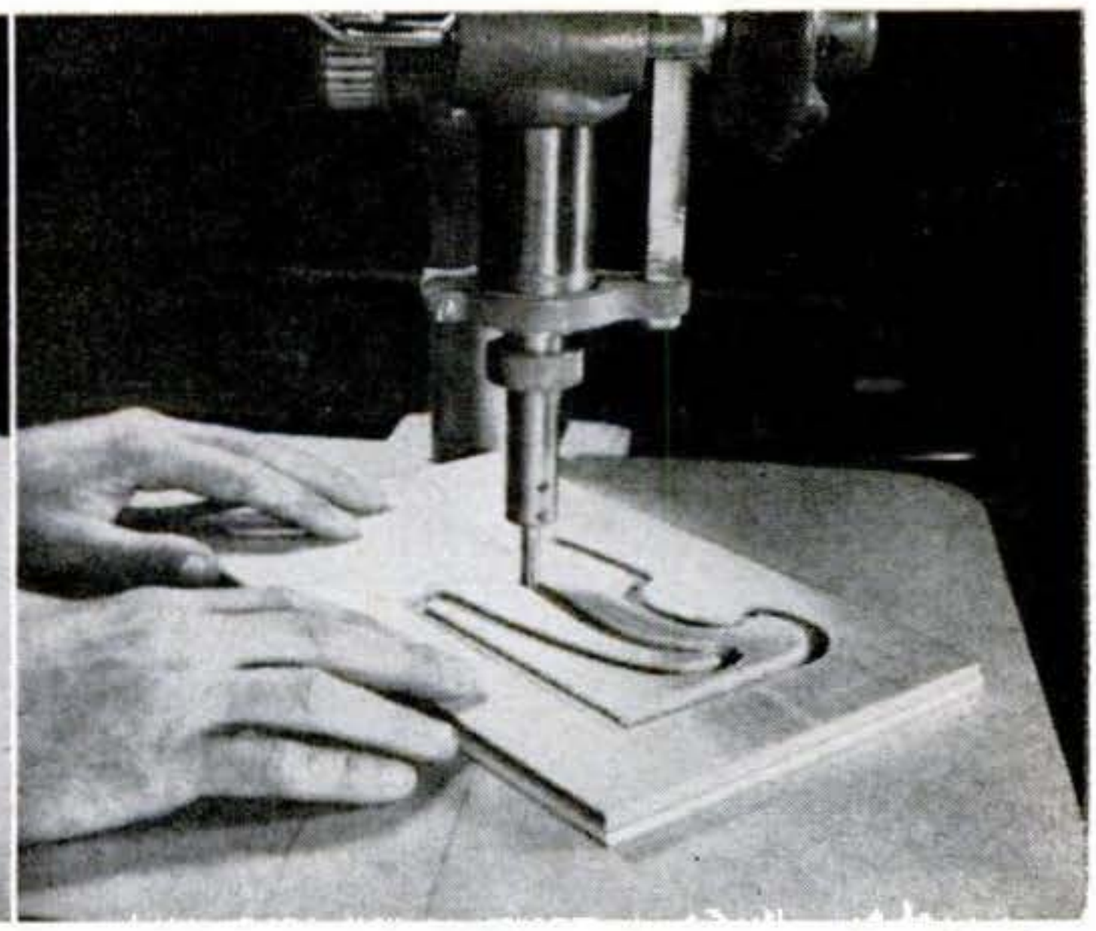
CURVED GROOVES automatically follow the edges of curved pieces with this pointed guide block tacked to the drill-press table. As the work is moved past the point, the cutter routs a groove the same distance from the edge.



CIRCULAR GROOVES can be made by rotating the work against a V block tacked or clamped to the table. With straight bits, using the same technique, you can cut completely through the wood to form large holes or circles.



PATTERN ROUTING is a quick way of making exact copies of intricate designs. The pattern rides against a pin set in the table directly below the router bit, as at left above. The work is then tacked to the pattern, as at right above.



Since the pattern follows the pin under the bit, any motion of the pattern allowed by the pin is duplicated in the work above it. For exact alignment, drill the hole for the pin with the router bit to be used in cutting the design.

with a Drill Press

5 Rules for Good Routing

1. Router bits require high speeds to cut smoothly. Use the highest drill-press speed available—at least 5,000 to 6,000 r.p.m. If you have a speed changer, you can go up to 9,000 or 10,000 r.p.m., but don't tax the quill by going any higher.

2. Always use a special router chuck to hold the bits. Conventional three-jaw drill chucks are not designed to take the side thrust of router bits.

3. Always feed the work *against* the cutter's direction of rotation. If you feed it the other way, the bit will try to pull the work with it and won't cut as well.

4. When you use a fence, be sure the thrust of the cutter, which is in its direction of rotation, is *toward* the fence. This gives a cleaner, more accurate cut because the thrust holds the work tightly in place. If the thrust is away from the fence, it tends to pull the work away with it.

5. Never cut deeper than about ⅛" at a time or it will strain the cutter and result in a poor job. Make deep cuts in successive passes, lowering the cutter slightly on each pass until you reach the desired depth.

CONTINUED

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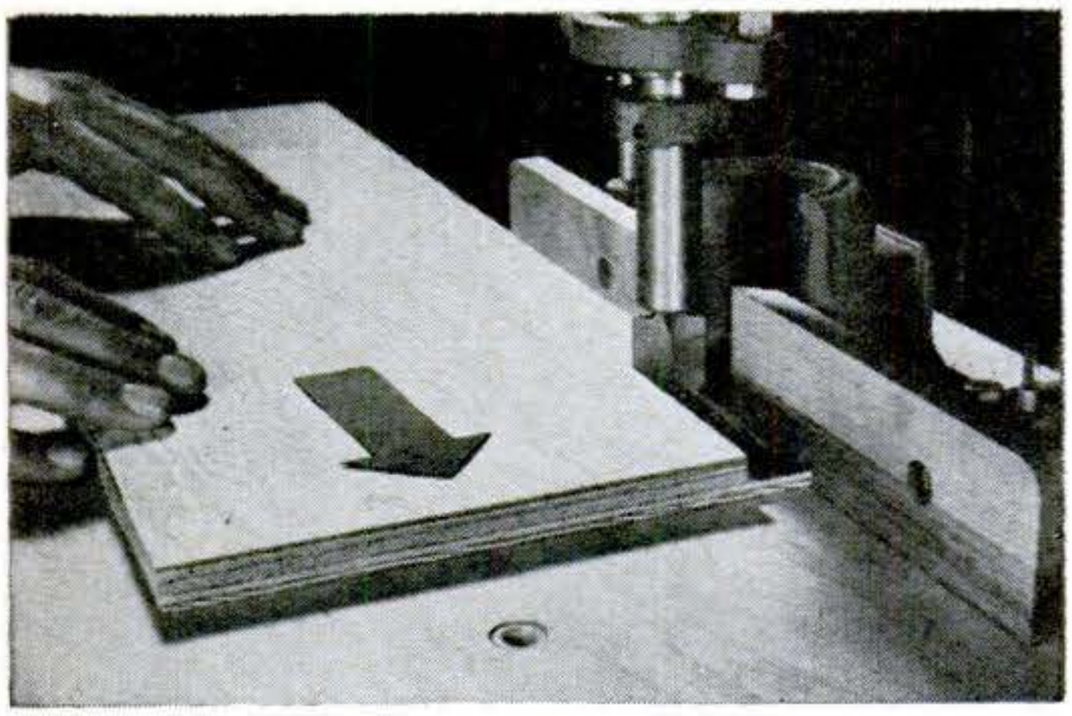
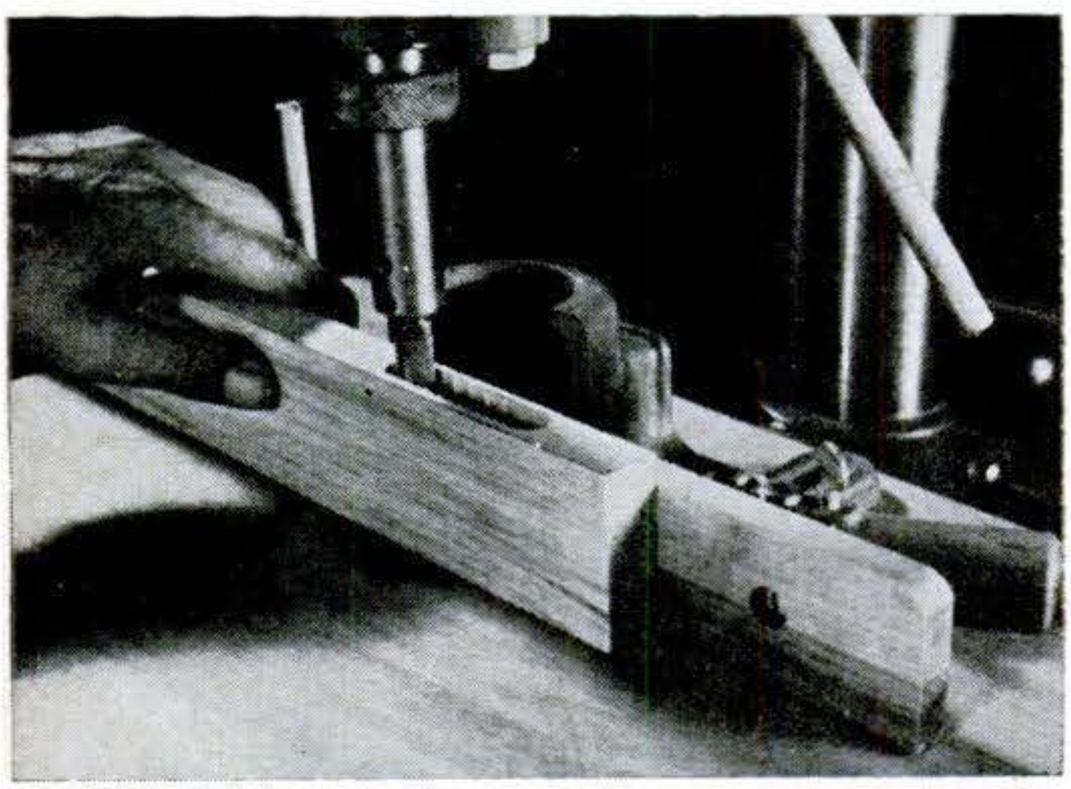
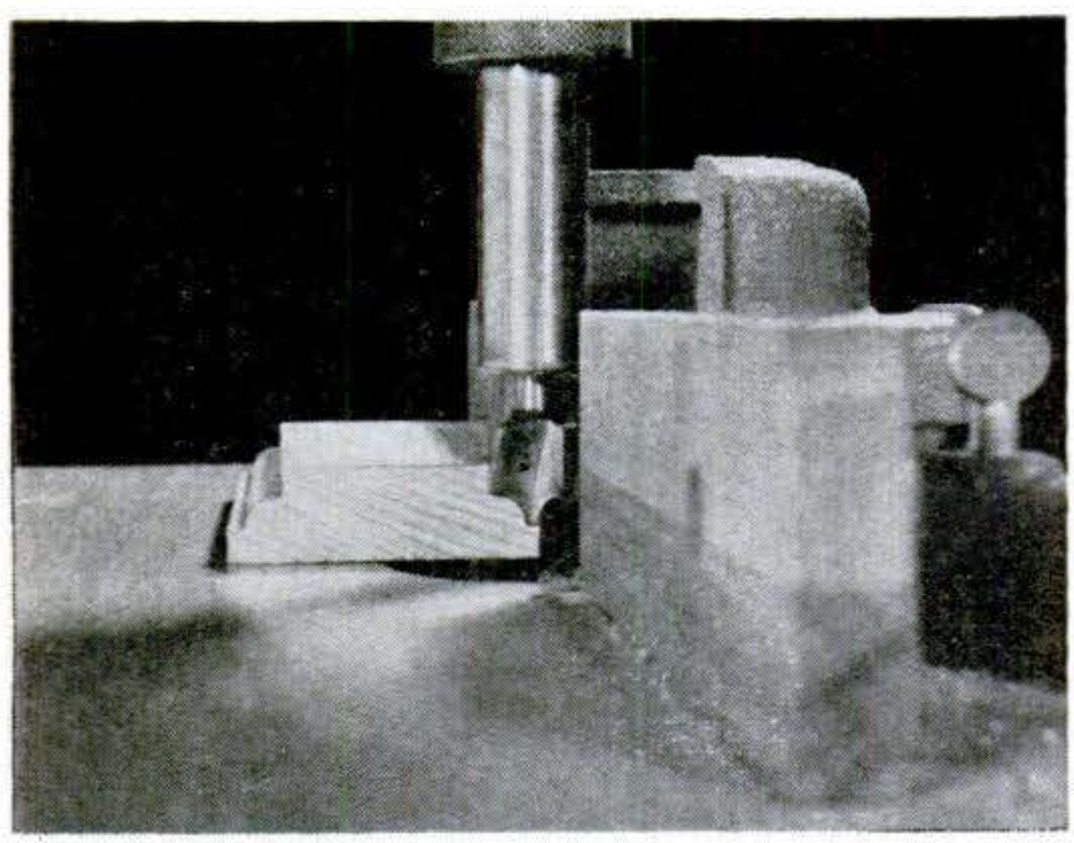
Jobs you can do with a commercial shaper table



RABBETS are often easier to make this way than on a circular saw since both width and depth are smoothly cut in a single pass. An accessory table and fence are used here, with the fence set back to permit the desired width of cut. Note that the work is fed (arrow) against the direction of the bit's rotation. This holds the work tightly against the fence.

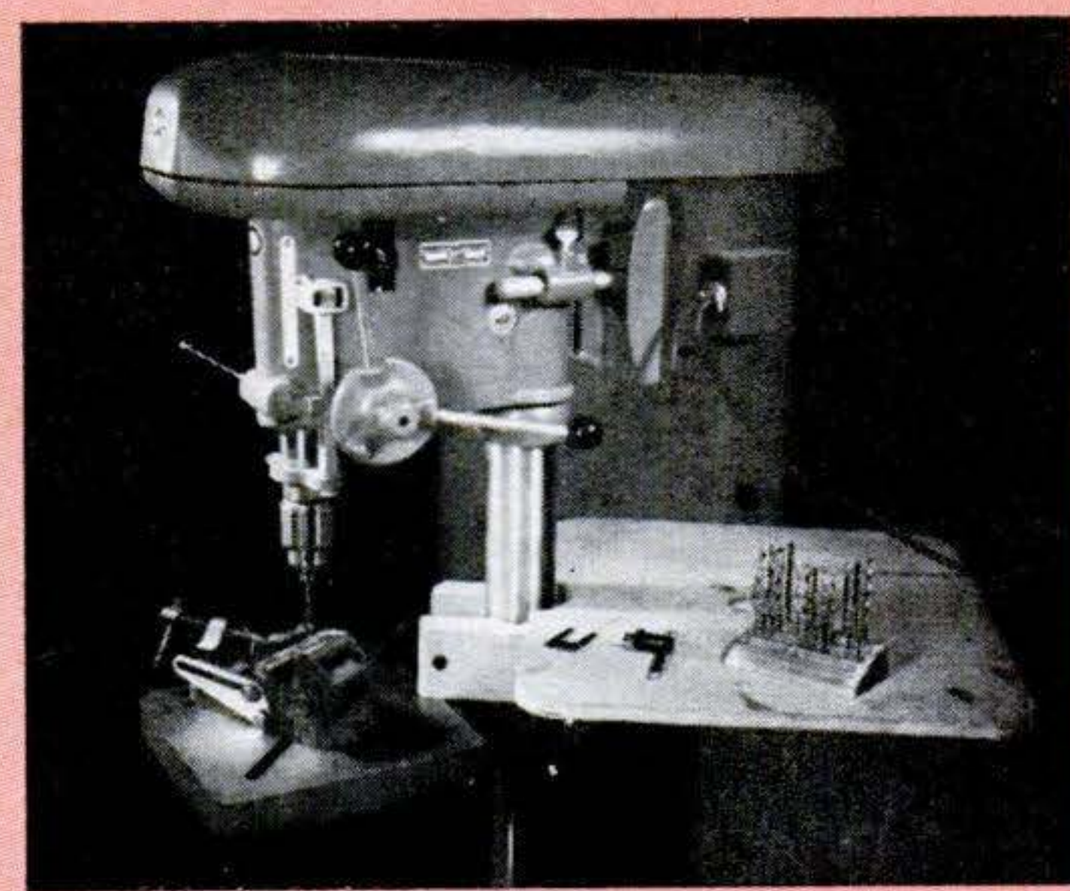


DEEP MORTISES are formed by using a router bit to "drill" a series of overlapping holes. The rough opening is quickly cleaned smooth by moving the work sideways under the cutter.

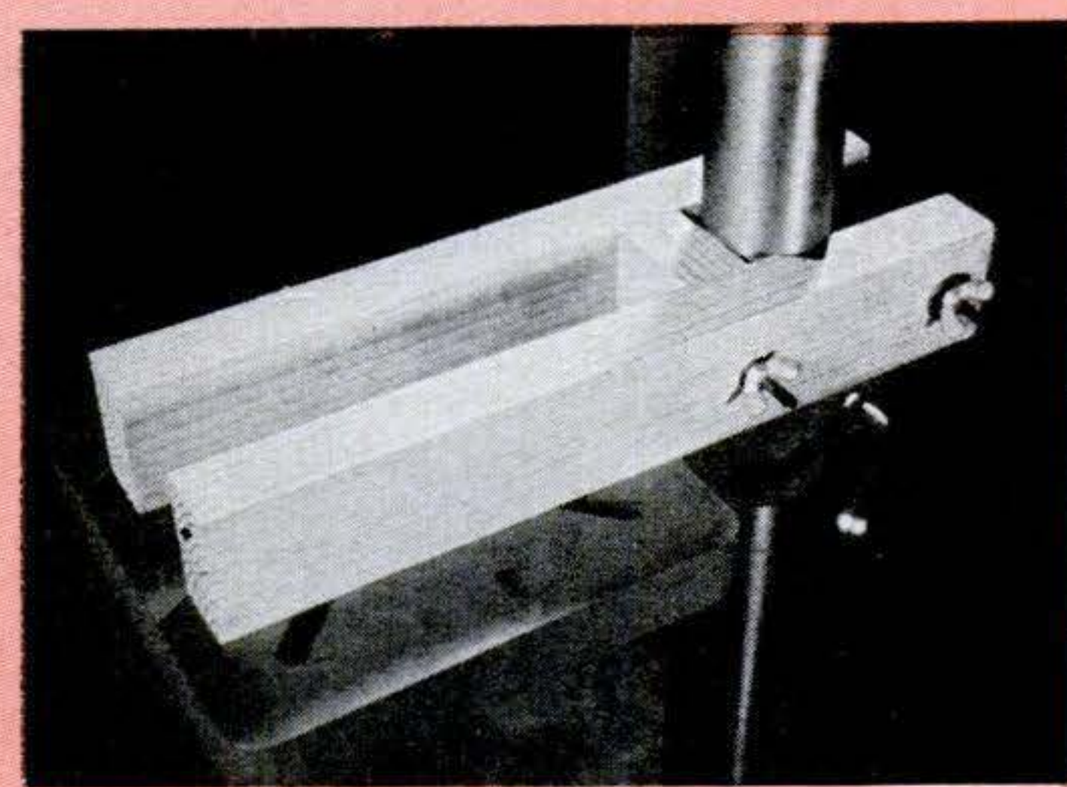


SHAPED CUTTERS let you decorate moldings, picture frames, and other edges. The fence can be adjusted to vary the width of cut, giving a variety of profiles from one cutter.

How to make an auxiliary routing



CLAMPED TO THE COLUMN of the drill press, this auxiliary plywood table swings quickly into place or out of the way. When not in use, the table makes a handy tool shelf.



BASE FOR THE TABLE can be made of stock two-by-fours, V-notched at the rear to fit around the drill-press column. Make the base first, clamp it tight, and screw the table on top.

can also buy shaped cutters that will put a fancy edge on a strip of wood or automatically make a difficult dovetail joint.

For jobs requiring a fixed fence to move the work against, you can use a commercial shaper table and fence made as an accessory to fit drill presses. The special table shown here is easy to make and has features not found in ready-made tables. The sliding H-shaped fence allows you to move the work straight into the cutter so you can rout across the width of the board, instead of only along its length.

You'll also find the special table handy

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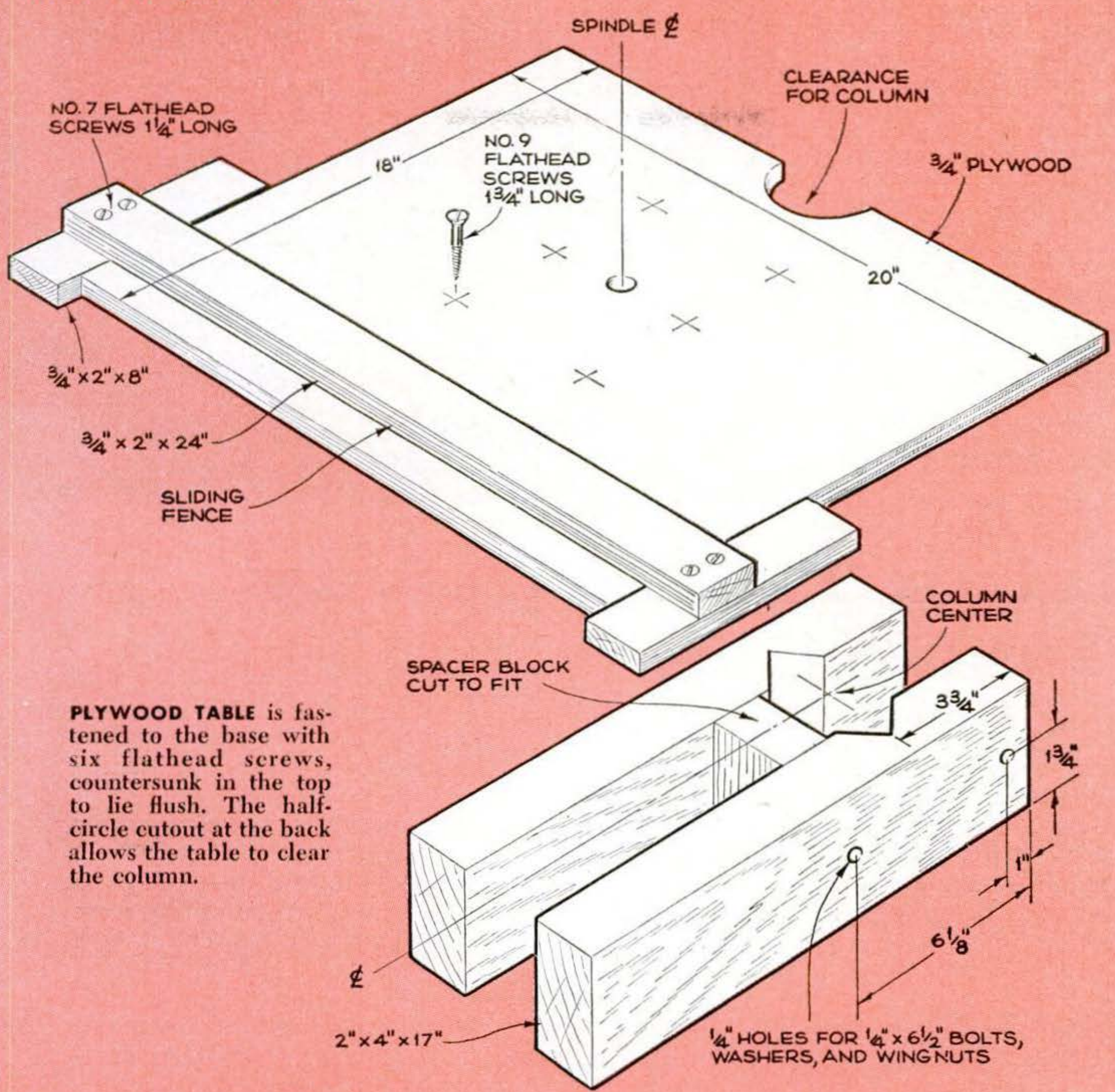
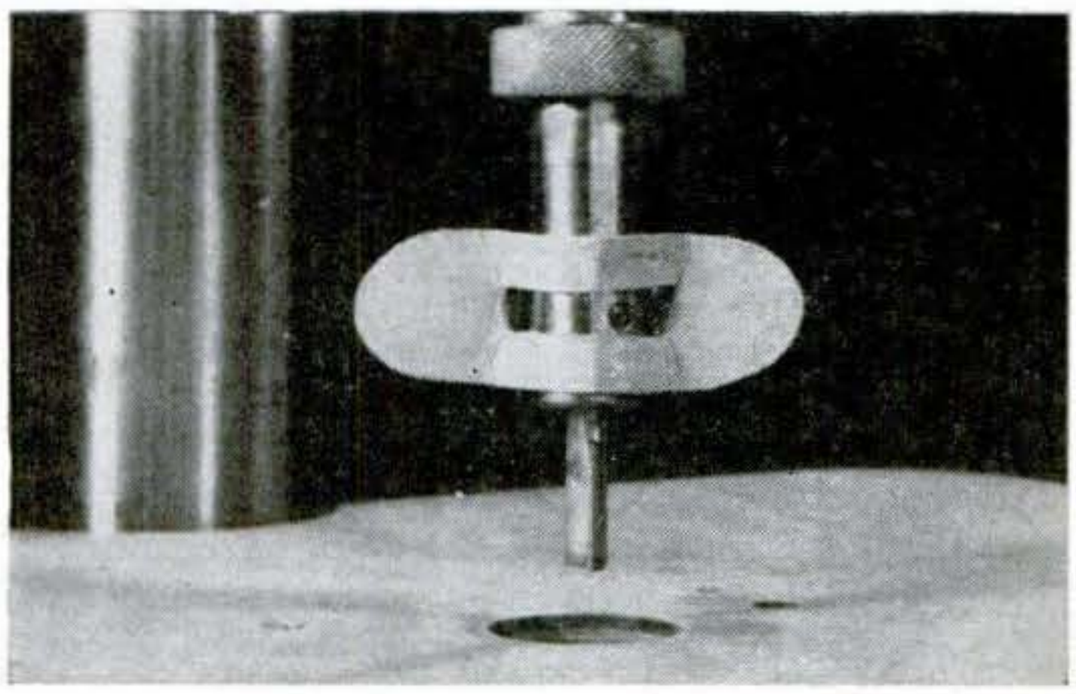
table for your drill press



PLYWOOD TABLE is fastened to the base with six flathead screws, countersunk in the top to lie flush. The half-circle cutout at the back allows the table to clear the column.

because it does not need to be removed when not in use. Two bolts and wingnuts clamp it to the drill-press column so that it can be quickly loosened and swung out of the way when you don't need it.

The table shown in the drawing will fit the column of any drill press. The spacer in the base can be cut to suit the particular diameter of your column. The top of the table should be made of a good, smooth grade of plywood. The type that comes surfaced with hardboard on one side makes an especially smooth table. Coat all surfaces with a resin-type wood sealer to prevent warping.



A NEAT TRICK TO KNOW: Make a cardboard fan to blow chips away as you work. Cut two slits in the card to form a loop that slips on the chuck. Use tape, if necessary, to hold it on.

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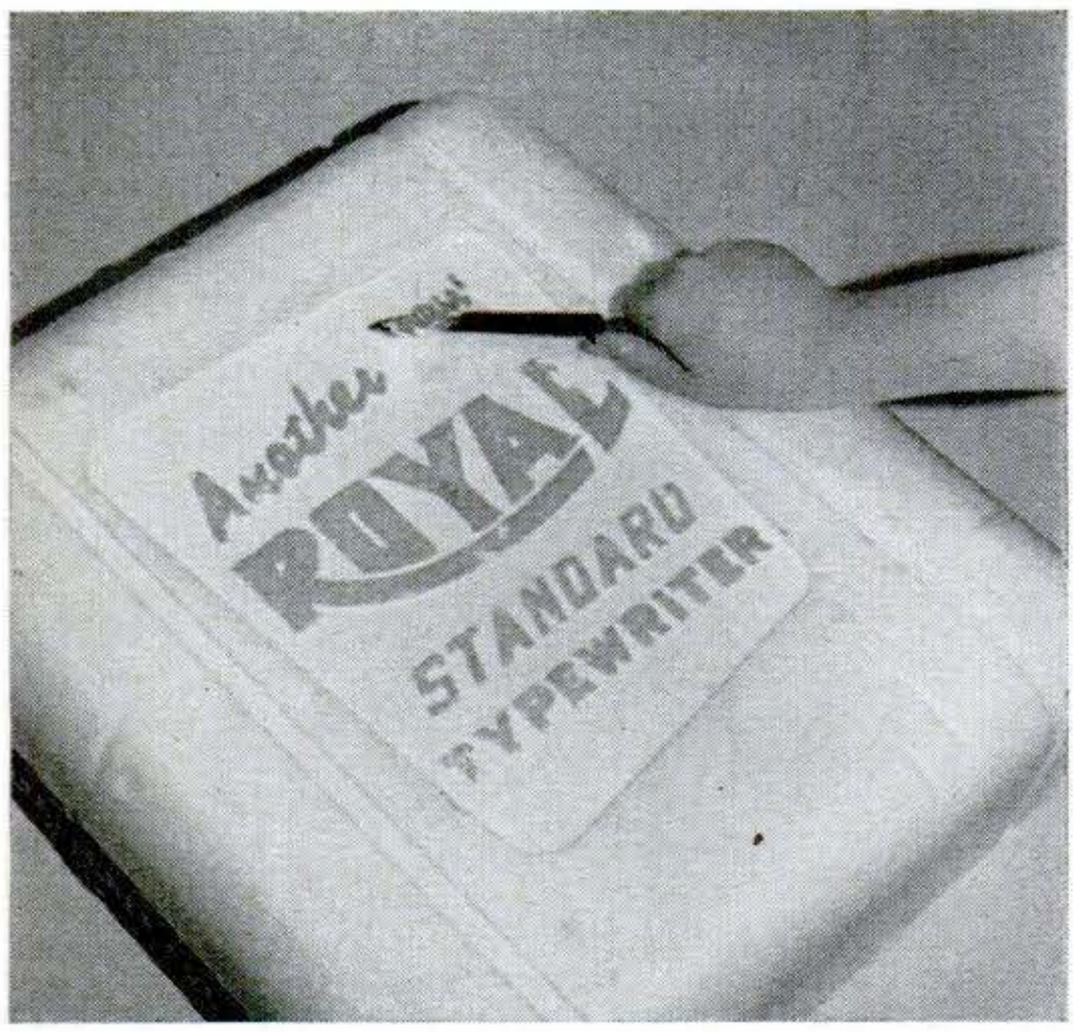
SUPER-BUOYANT RAFT (or boat dock or diving platform) weighs only 45 lb., yet can support eight persons. It is made from 10 styrene cases, sealed with plastic tape at the lid joints and lashed with plastic rope to a wooden frame underneath.

Remember when grocers gave you free—and useful—wooden boxes? Now the old custom has a modern slant

Using Throw-Away Plastic Cases

YEARS ago, you could get wooden grocery boxes free, prime material for cobbling up anything from a scooter to a birdhouse. Now they're scarce. But progress has filled the gap with a new kind of container. It's the polystyrene case, packed with potentialities all its own.

Feather-light, waterproof, full of air cells, these plastic boxes take to water better than ducks. They're just the thing for floats, buoys, flotation chambers, kickboards, and fun craft.



RAISED MOLDED LETTERING can be removed easily. Slice it off cleanly with a knife. When sanded smooth, the surface can be painted with any ordinary enamel or oil-base paint.

That foamy plastic is a good insulator for keeping heat in or out, is strong enough to stand on, and is a cinch to work. You can cut it with anything from a dull saw to a bread knife, shape it with rasp or sandpaper, paint it with enamels, sand it to a velvet finish, join it with water-mixed glue or cellulose cement. (Avoid styrene cement, which forms cavities at the joint.)

Custom-molded styrene packs are now used for typewriters made by the Royal McBee Corp. Any of this company's distributors having cases on hand will give them to you free. Schools receiving new Royal typewriters (usually in September) may have cases to dispose of. The purchasing agent of any big office getting such machines may be glad to get rid of the bulky containers.

Try them for toy and storage chests, warm pet beds that need no padding, picnic coolers and hot-food keepers. Frozen foods in a closed case will stay cold on long shopping trips, or while you defrost a freezer or refrigerator. Keep styrene away from high heat and flame; it burns about like soft wood, but with more smoke.

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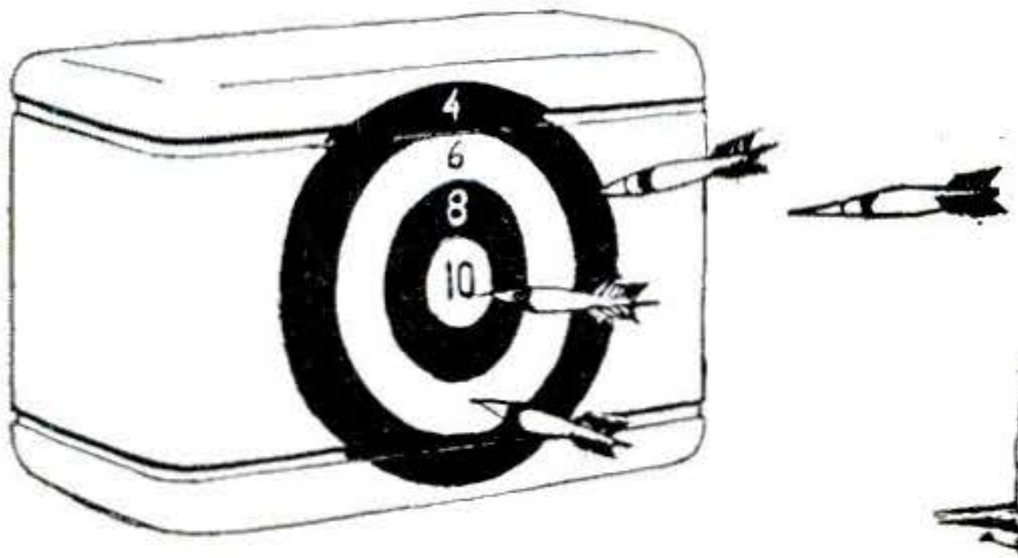
Eight practical ideas for using styrene cases



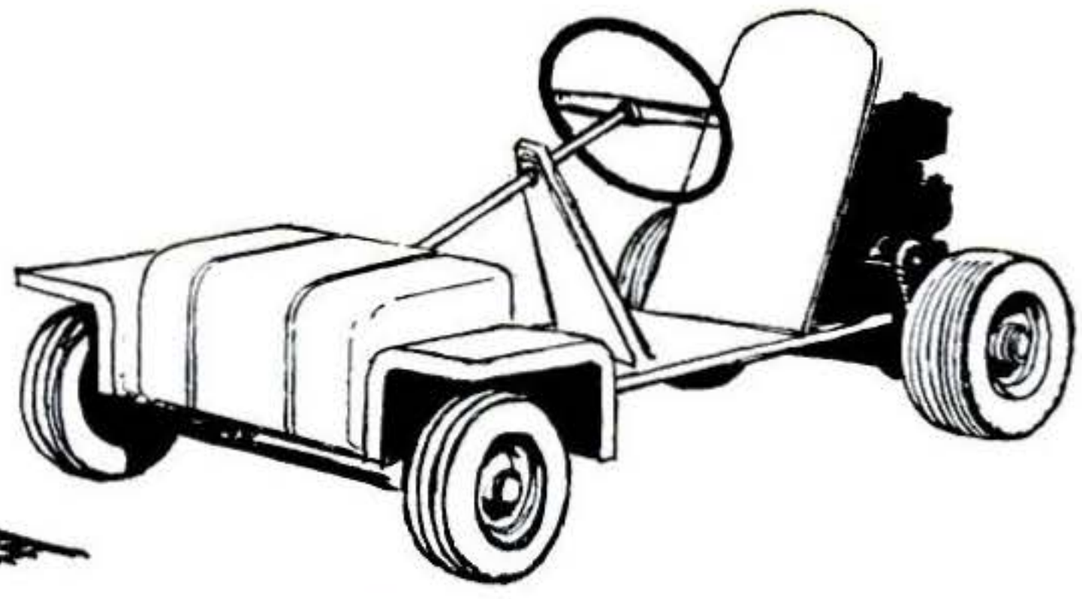
PAINT TARGETS on lids and bottoms of cases for dart games and air-rifle practice. The little pellets won't ricochet.

A BOY'S KAYAK or fun float is made by lashing two tape-sealed cases to a wide plank with plastic clothesline. Virtually unsinkable, it floats either way up.

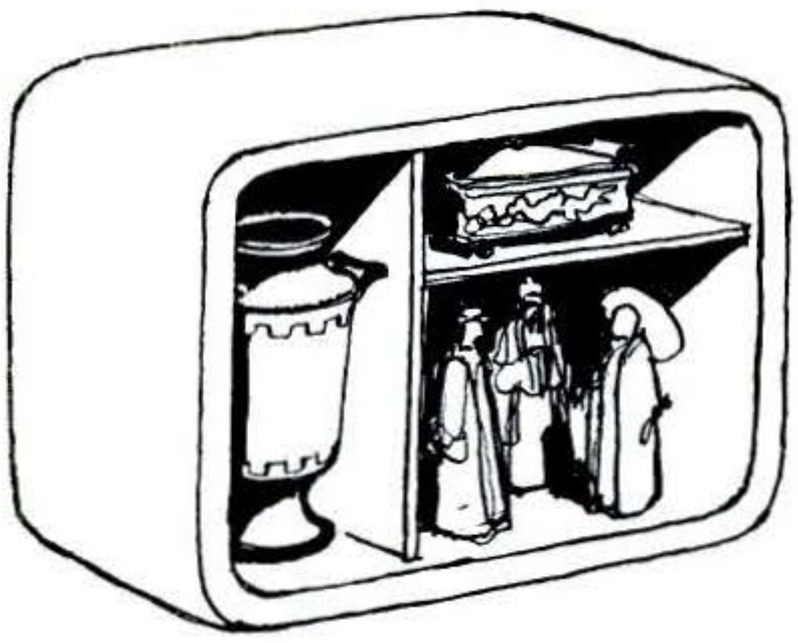
FOR TV HASSOCKS and foot stools, cement case halves together. Paint or cover. A wooden back can be bolted to wooden strips inside.

OUTDOOR PLANT TUBS, left white or painted in colors, stand any weather. Poke drain holes in the bottom, put gravel under the soil. Wire trellises can be stuck into case edges.

TUNNELS AND CLIFFS for model railroads can be made of case halves. Extra styrene, cemented on to achieve realistic contours, is painted and planted with model shrubbery and trees.

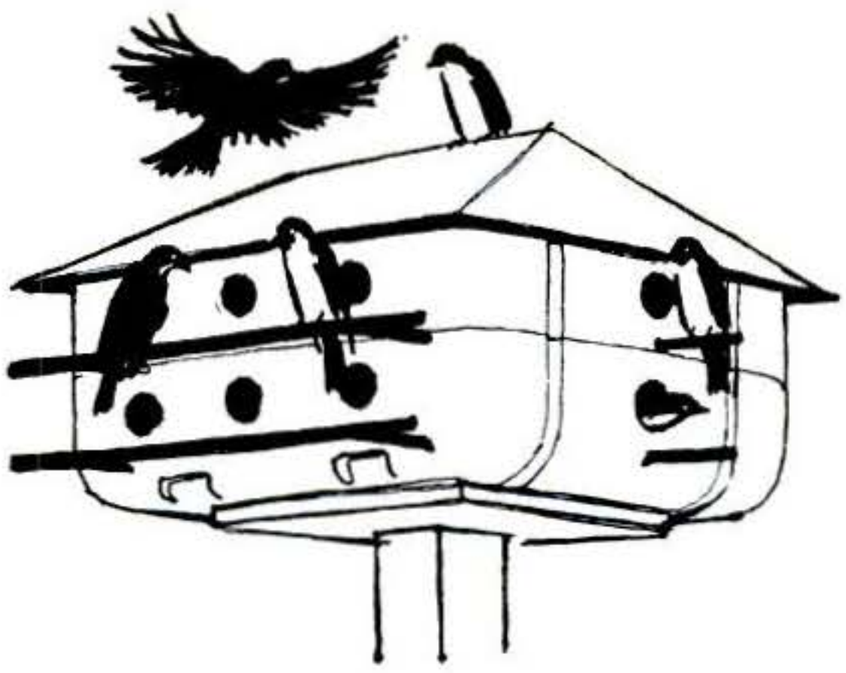


HOODS AND BUMPERS for midget motor carts are half or quarter sections of case lids or bottoms. Use washers or straps under the bolt heads. Keep styrene away from the engine.



MODERN SHADOW BOX is made by cutting out inside blocks. Back and walls may be cut thinner. Sand out imperfections, install wood shelves, and enamel.

COOL WREN HOUSES or homes for other gregarious birds can be two-storied, with wooden floor and partitions, shingle or metal roof.



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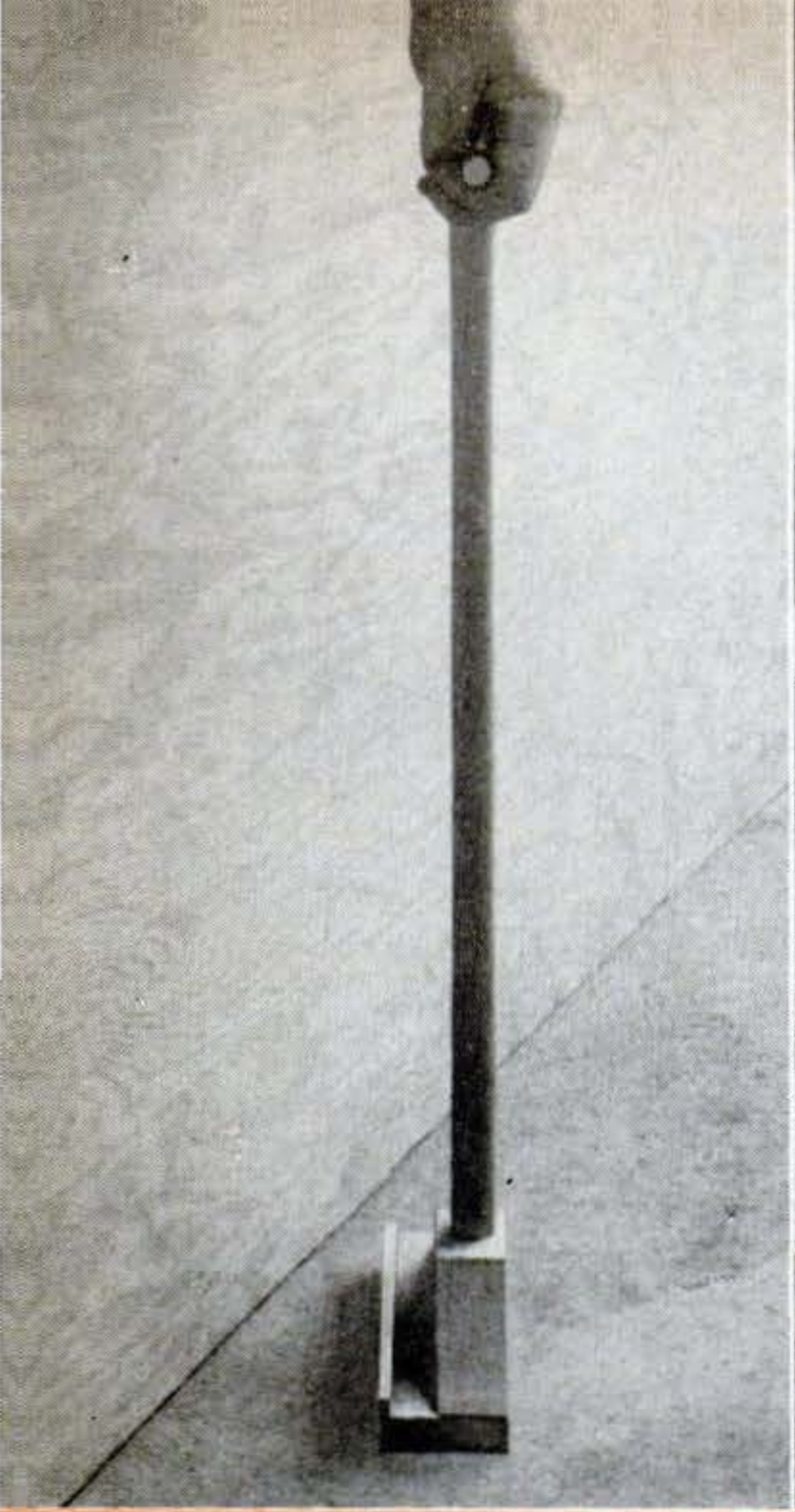
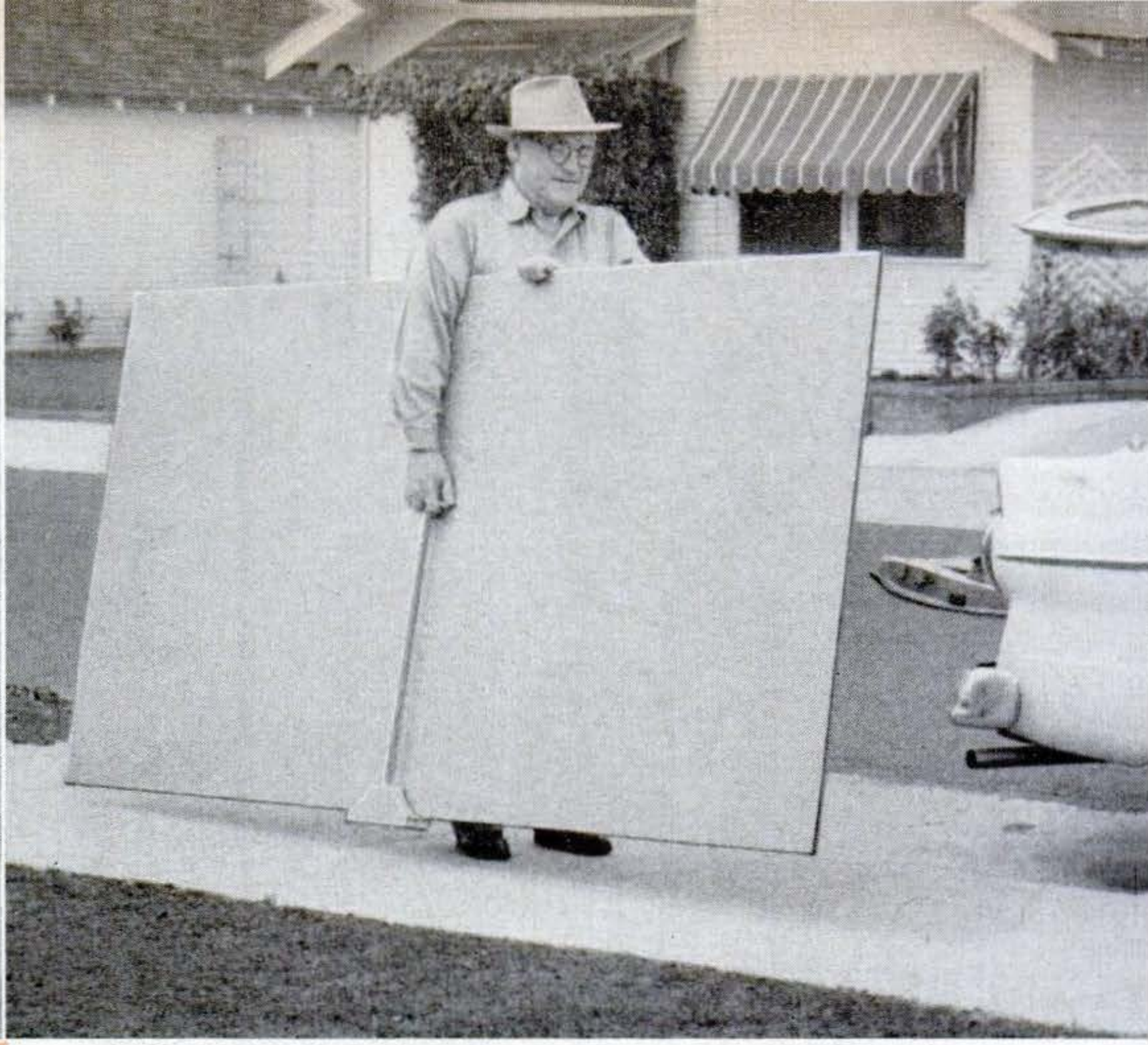
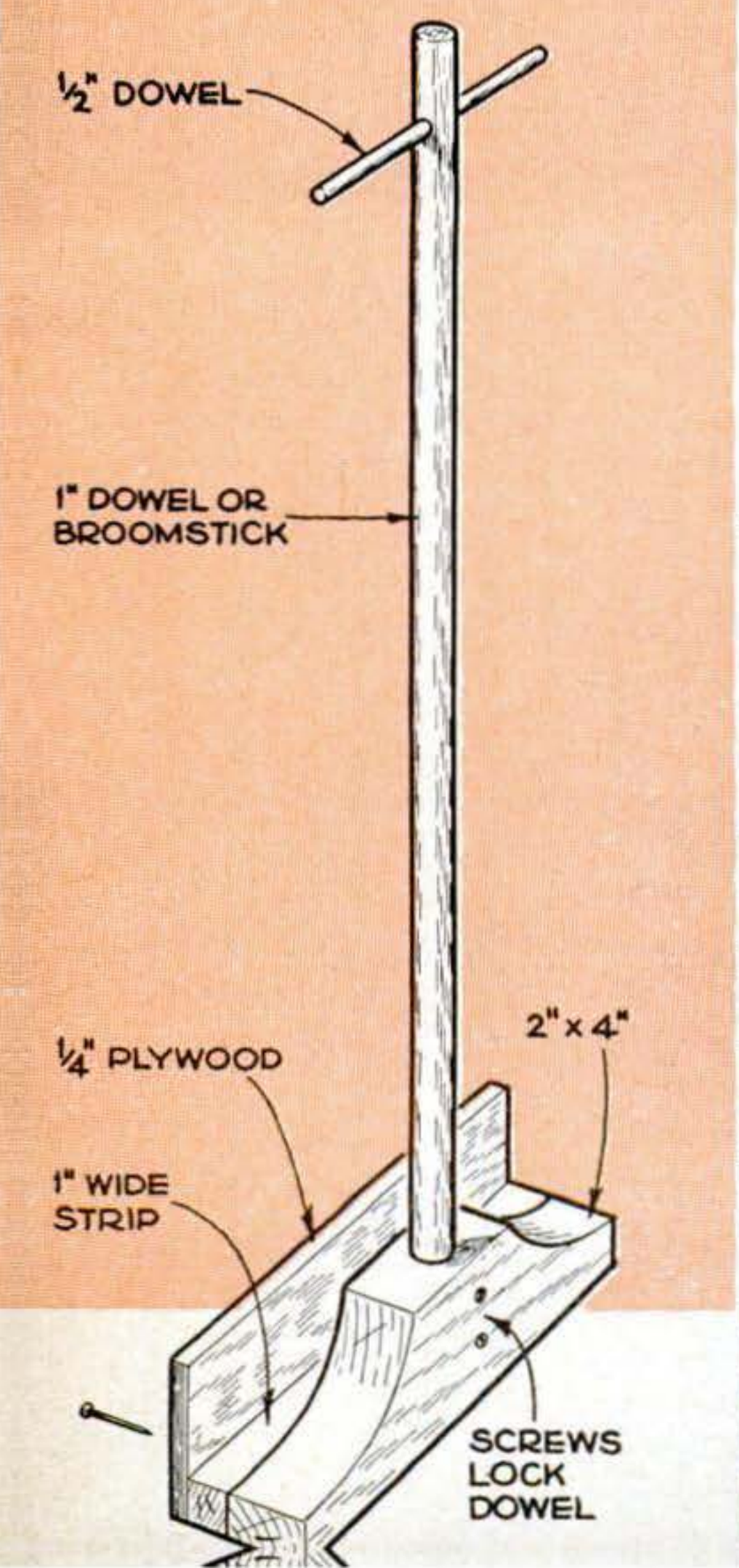




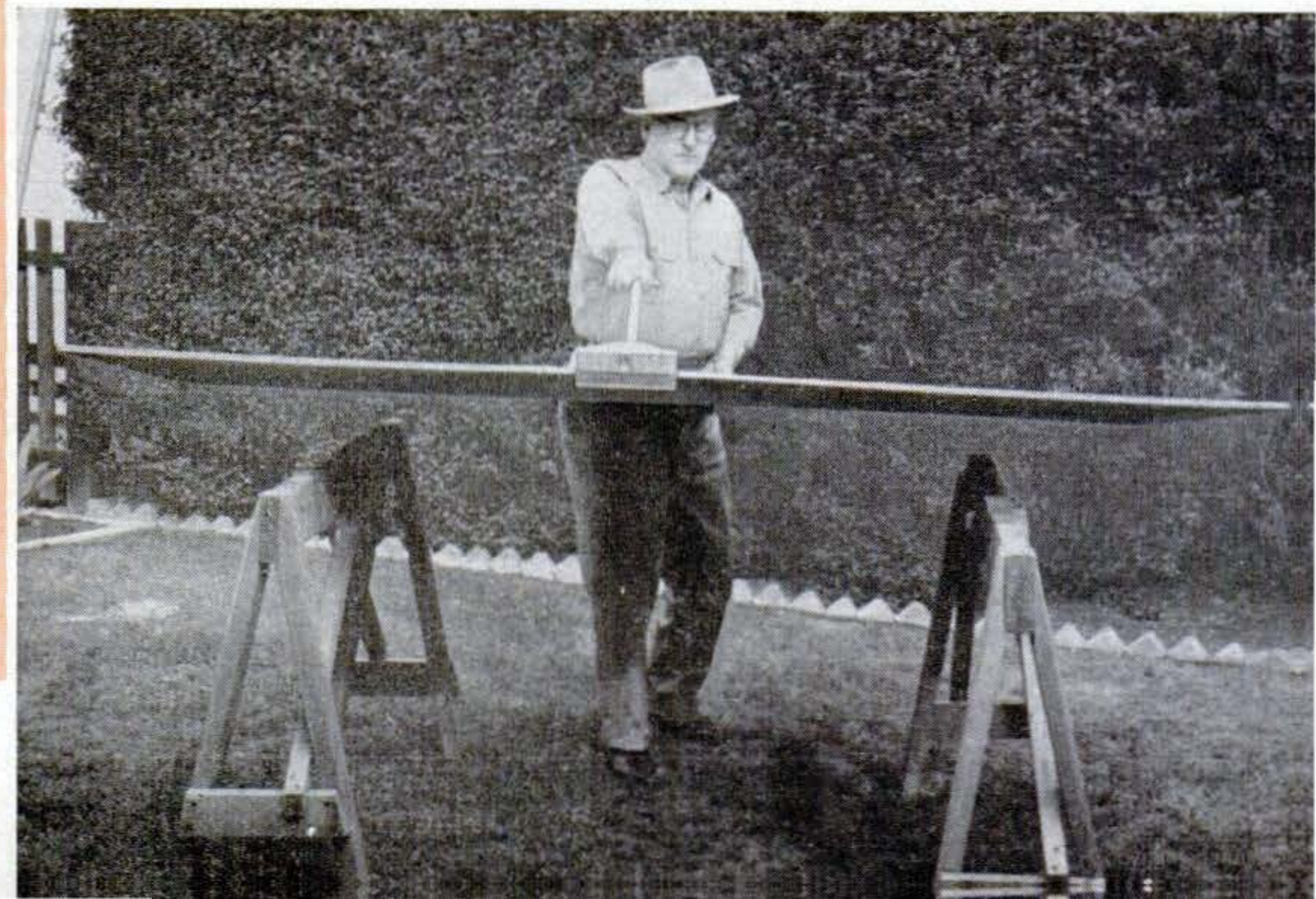
U-SHAPED GROOVE to grip the panels is built up by screwing three strips together, as in the sketch below. The handle is anchored with screws in a hole drilled in the two-by-four block.

T-HANDLE HOOKS UNDER THE OUTSIDE of large plywood panels, lets you tuck them under your arm and walk off unassisted. It was devised by R. S. Waggoner, Sacramento, Calif.

How One Man Can Carry Big Panels



NO DANGER OF MARRING: T-handle lets you gently pick up or lay down large panels in a flat position, as across sawhorses.



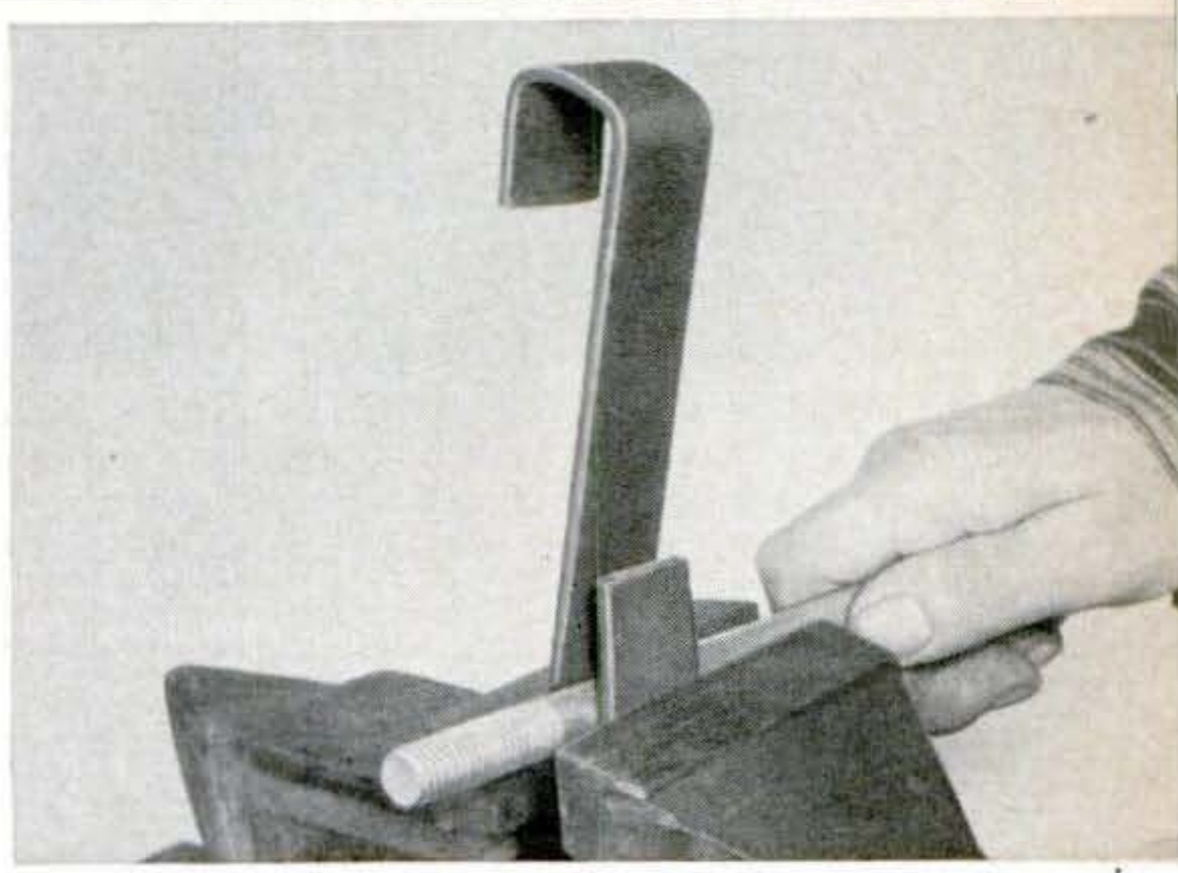
SLING HOOKS ONTO THE INSIDE of heavy panels so you can hoist them up on your shoulder to make it bear part of the load. It's the brain-child of Ralph Treves, Jamaica Estates, N. Y.

HEAVING around heavy panels of plywood and other materials isn't easy by yourself. Here are two ingenious aids that enable one person to pick up and carry 8′- and 10′-long sheets single-handed. Each has advantages.

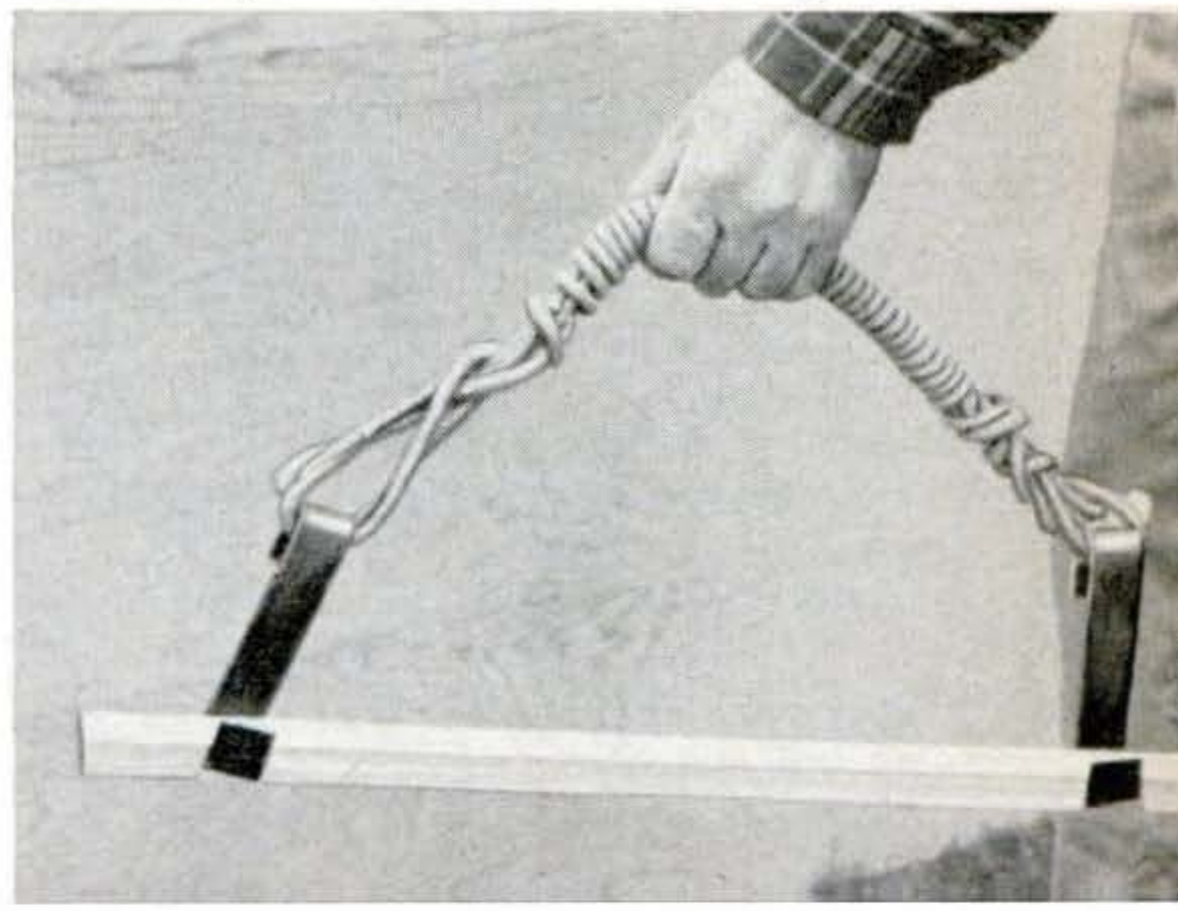
The T-handle on the facing page, devised by R. S. Waggoner of Sacramento, Calif., lets you sling a 4′-wide panel under one arm. The panel is balanced at the center and is easy to support. The handle also makes it possible to pick up large sheets lying flat or put them down without scratching costly veneer.

Panels too wide or awkward to be tucked under your arm can be carried in the sling rigged up by Ralph Treves of Jamaica Estates, N. Y. This type lets you hoist the panel up on your shoulder and is ideal where you have to carry it high to clear obstructions or stairways.

Both carriers grip the panels at the edges so there's nothing to mar the surface. The T-handle should be made according to your own arm length so it's just long enough to reach between your fingers and the lower edge of a 4′-wide panel. The sling consists of a rope handle on two hooks held apart by a wood strip.



TWO HOOKS, bent from ⅛″-by-1⅛″ strap steel, are spaced apart by a 1″-square stick, 18″ long, to form the sling. The stick is notched near the ends so the hooks can't slip off. Clothesline tied between the hooks and coiled around itself forms a comfortable handgrip. Bending the hooks is easy if you form them around a large bolt squeezed in a vise. Each hook starts out 9″ long, has a U-shaped bend at one end and a rounded eye at the other for the rope.

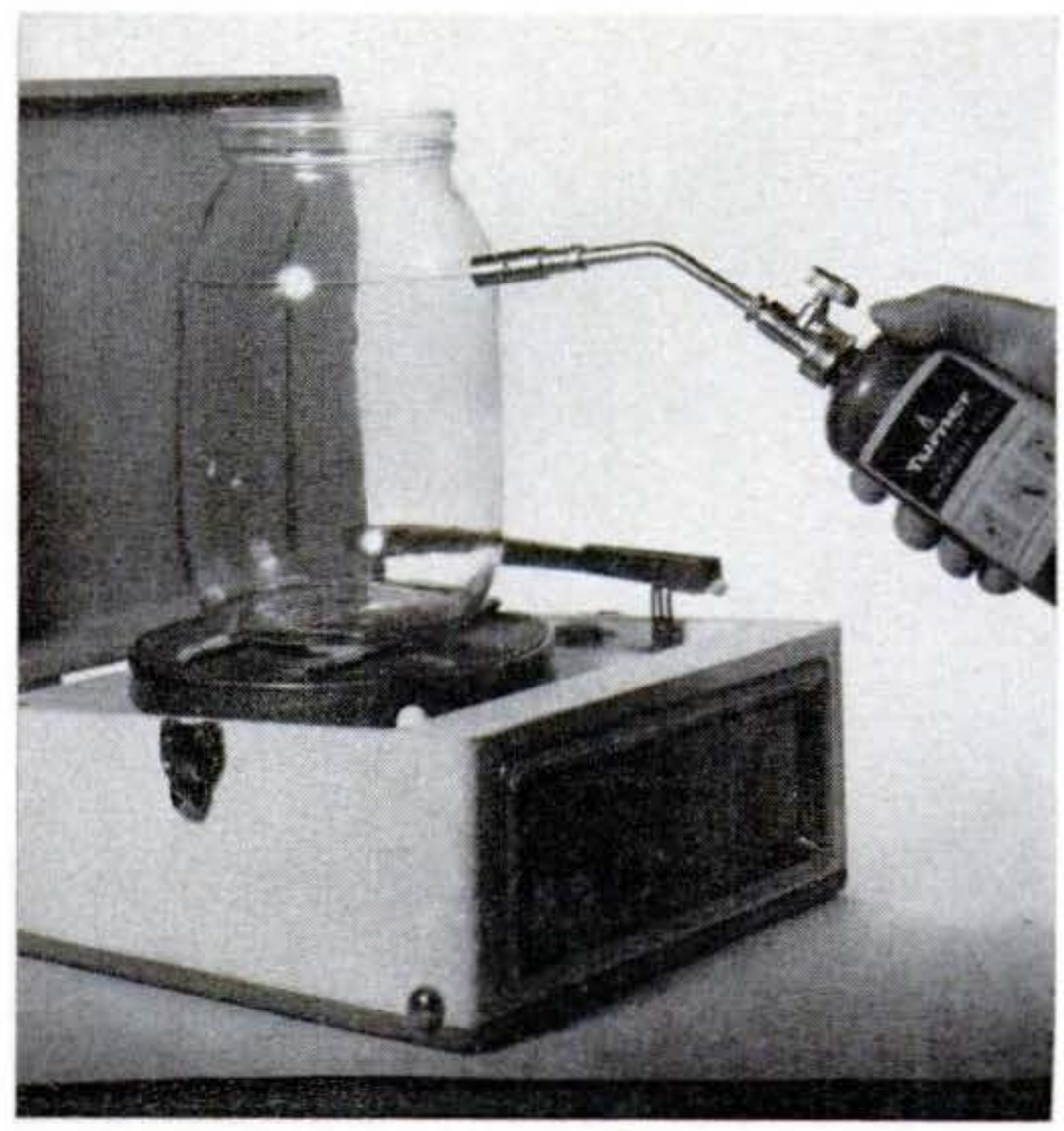


Cutting Bottles with a Torch

By Carlton G. Bucher

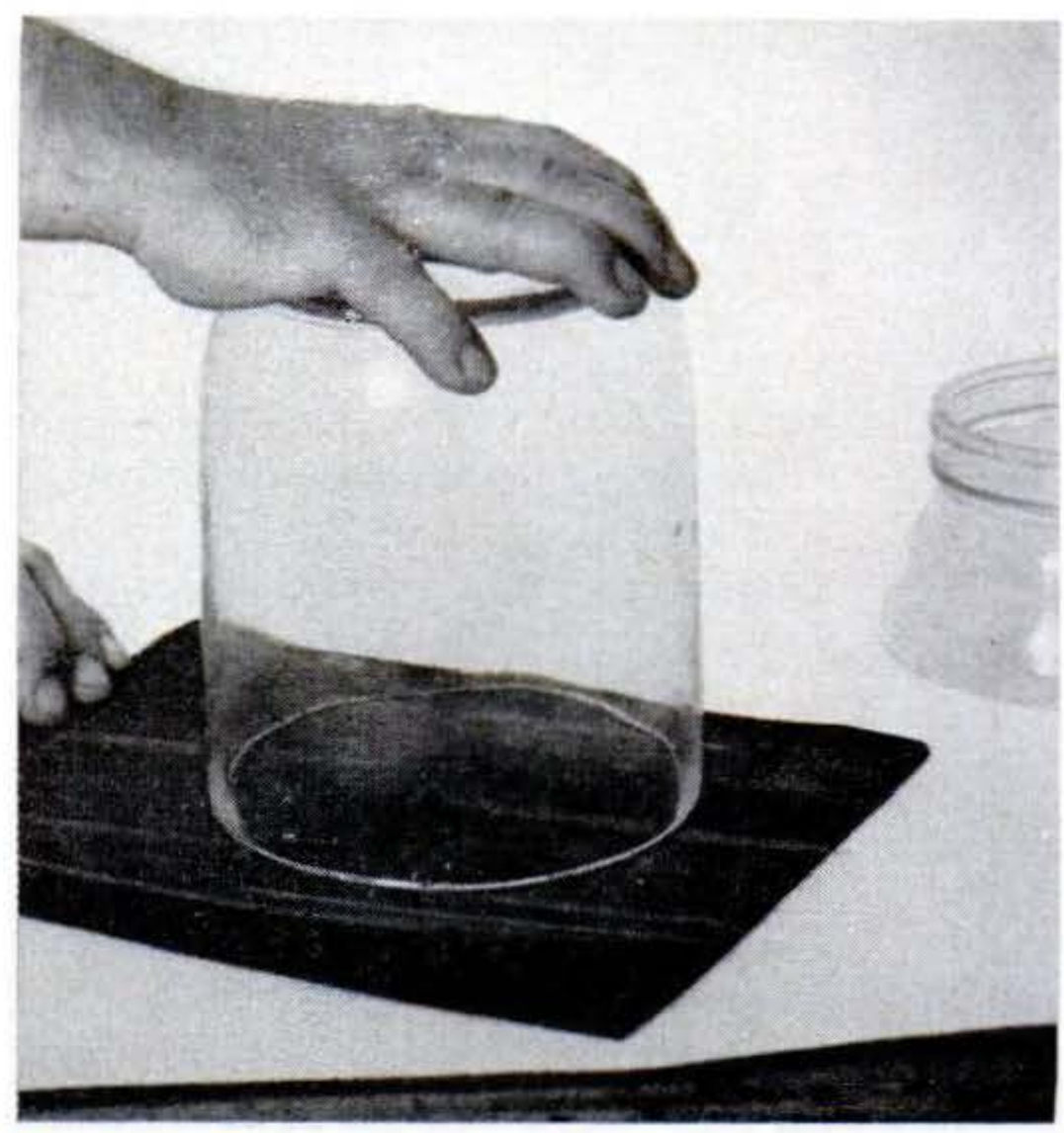
Fish bowls, terrariums, bell jars, funnels, and raffia-wrapped drinking glasses all can be made from bottles if you know how to cut them. Here's a method that's nearly always successful

CLAMP THE GLASS CUTTER at the desired height to anything that will hold it rigid—a block of wood, chair leg, or bench vise. Press downward as you rotate the bottle against the cutter to score the glass in a straight line.



HEAT THE SCORED LINE with a propane torch, turning the bottle slowly. More even heating of the glass can be obtained if you place the bottle on a record player. Run it at slowest speed as you hold the torch steady.

LIFT OFF THE TOP after you hear the tinkling and crunching sounds caused by heating. You will also be able to see the glass fracturing at the scored line as you apply the heat.



SMOOTH THE EDGE by rubbing it over a sheet of emery or silicon-carbide paper held or tacked to a smooth surface. Round any sharp corners with small pieces of abrasive held in the hand.

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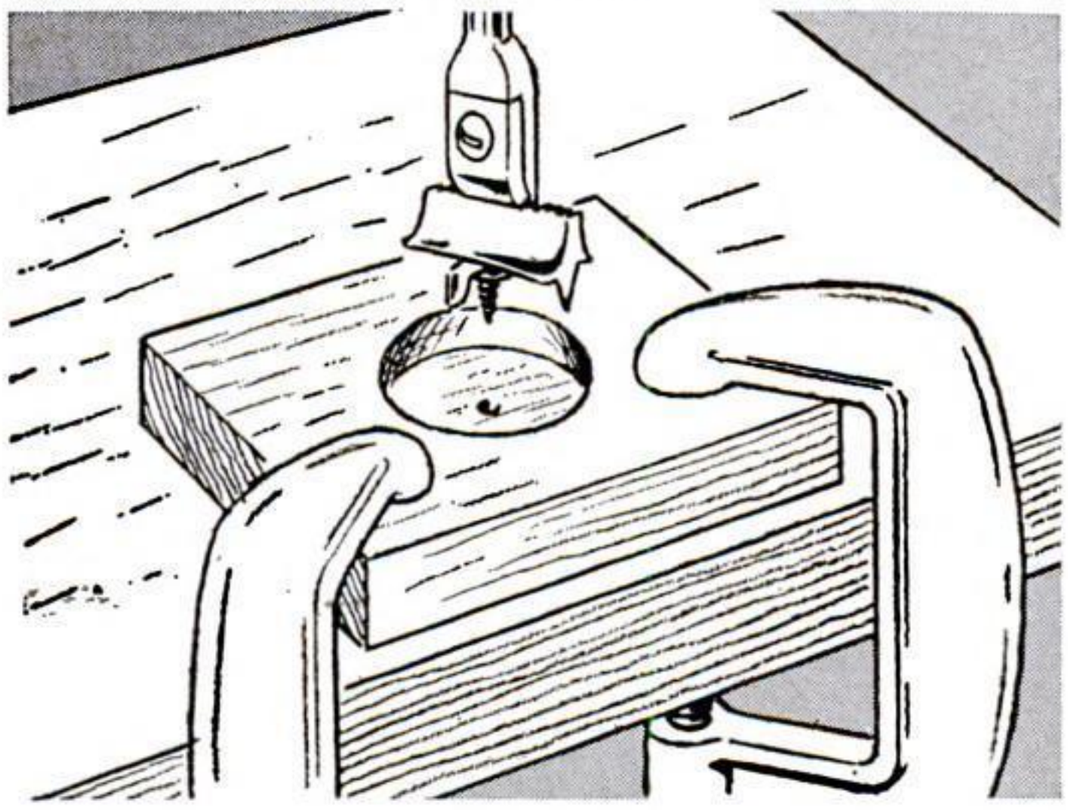
Short Cuts and Tips

FROM PS READERS

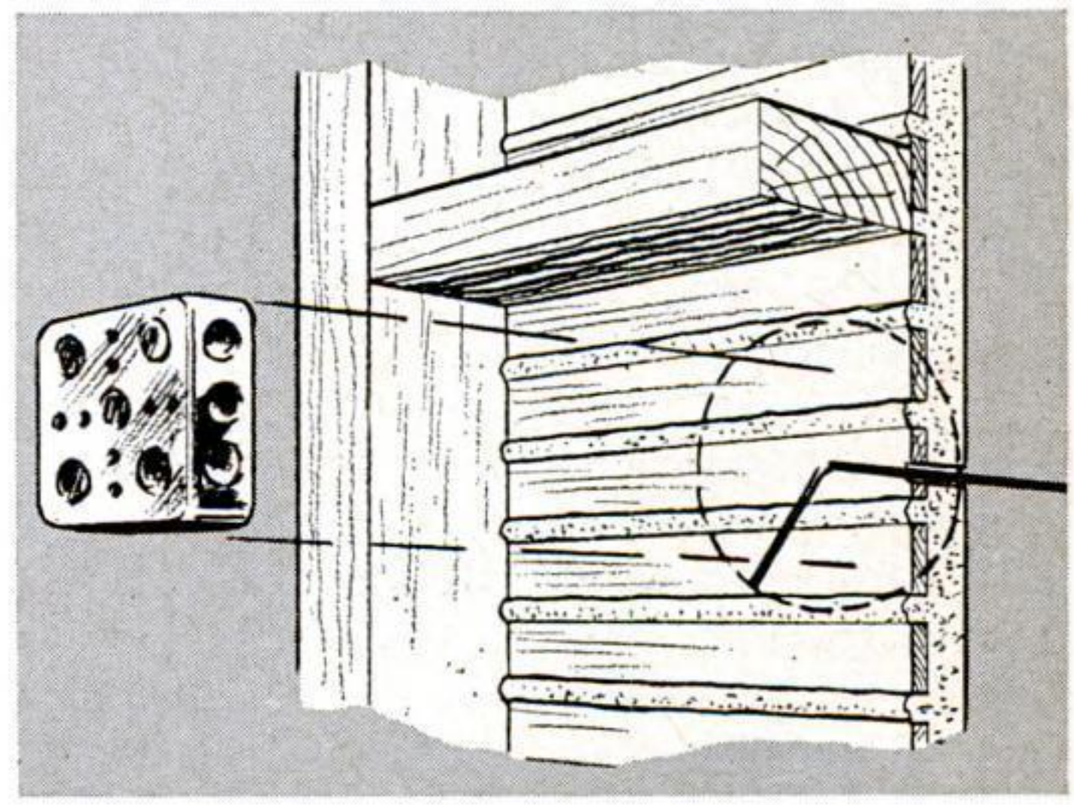
Empty Can for Extra Brushes

WHEN I'm painting, I tape an empty tin can to my paint can. The tin can makes a fine place to put my brush when I stop work briefly. If a smaller brush is needed for trim, I keep it there, too.—*A. Zawistowski, Coon Rapids, Minn.*



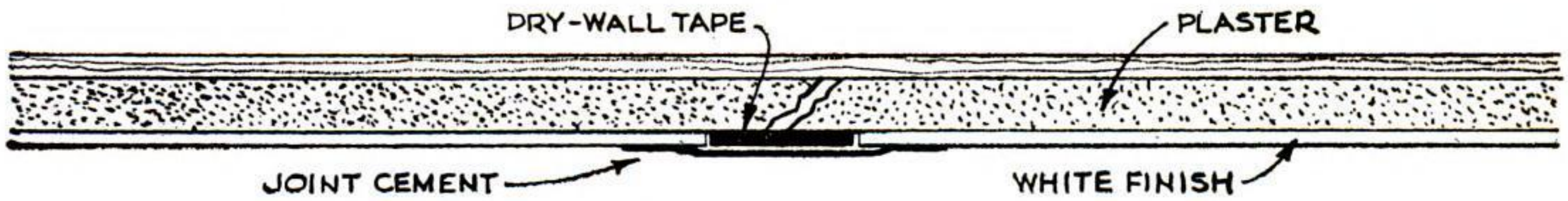
Enlarging Holes Accurately

EVER try to drill out a large hole from a small one? The drill bit just wobbles and ruins the hole. Here's a way to do the job: Drill a hole the size you want in scrap wood and clamp this over the small hole. It will guide the drill perfectly. If you also clamp a solid piece of scrap under the hole, the edges will come out neat and clean with no splintering. —*Phillip J. Shuler, Acton, Calif.*



Wire Probes Outlet Location

IN WIRING an old house, you sometimes find a stud or other obstruction just where you'd like to locate a junction box, making it necessary to patch the hole you cut in the wall. I use an L-shaped wire probe to avoid cutting such unusable holes. The 2″ leg of the probe is pushed through a small hole and rotated to see if the area is clear. If not, the hole is easily filled.—*Carl C. Celaschi, Kent, Ohio.*



Patching Big Plaster Cracks

HERE'S a new way to repair those pesky stress cracks in plaster that refuse to stay patched. Chip off the white coat 1½″ to each side of the crack and embed dry-wall joint tape in the recess, using dry-wall joint cement. Finish it off as you would a regular dry-wall seam, sanding and feathering the edges of the cement smoothly. This method works especially well on stress cracks because the patch remains flexible enough to withstand further shifting. As a builder, I know.—*James Rouse, Danville, Ill.*

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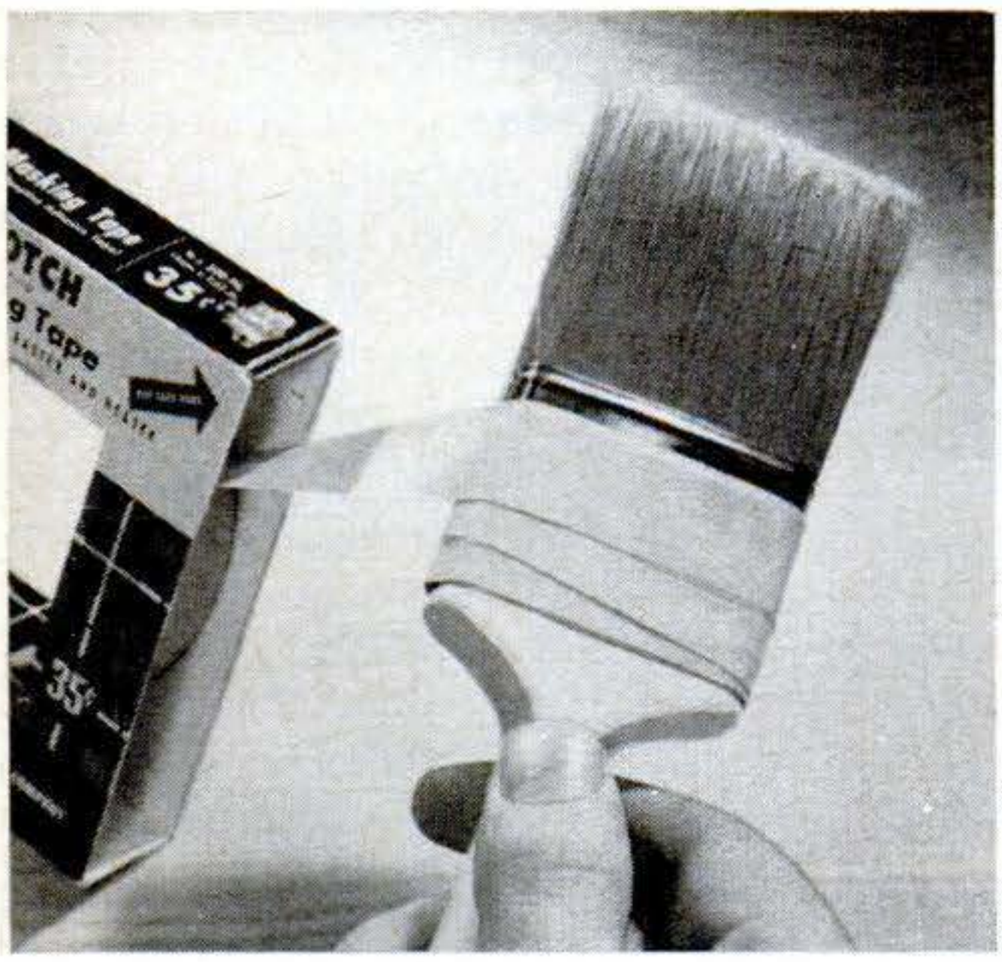
Earth Auger Beats Spades

As FAST as two men can move it from mark to mark, this power auger digs 8″-deep holes for transplanting small trees at the Felger Plant Farms in Mahoning County, Ohio.—*John Krill, North Lima, Ohio.*

▶▶▶An OLD metal camera tripod that telescopes into a compact package is handy for camping. Pull out the legs and spread them fully apart to straddle the campfire. You can then hang the cooking pot from the tripod head on a piece of wire of suitable length.—*Ken Murray, Colon, Mich.*



Tape Keeps Brush Clean

You'LL have less cleaning to do if you keep the ferrule and top of the paintbrush bristles clean by wrapping them with cellulose or masking tape before you begin to paint. When through painting, strip off the tape.

MAKING A Compressor from a One-Lunger

By Rowland M. Hill

EVEN though worn beyond usefulness as an engine, any four-cycle one-lunger can be made into an efficient air compressor with little effort.

After stripping off the blower, magneto, and carburetor, you have only to modify the valving to make the engine pump air. This is a simple job. Remove the cylinder head and the crankcase end and knock out the pin on which the camshaft rotates. With the shaft removed, the valve lifters will drop free. Discard the lifters and the camshaft, but drive the pin back into position to close the opening in the crankcase wall.

Pry the valve springs from the retaining washers with a heavy screwdriver and remove the retainers, thus freeing the valves. Lap the valves in their seats with fine grinding compound, then clean all the parts. Replace the intake-valve spring with one light enough to allow the valve to open and admit air as the downward stroke of the piston creates cylinder vacuum. Install the exhaust valve with its original stiff spring so that it permanently seals the exhaust port.

Removing the piston for cleaning is a good idea at this point. With the rings in place, soak the piston in lacquer thinner; then rotate the rings in their grooves to free them and clean out carbon. Unless cracked, the rings need not be replaced. Apply light oil to the rings and wrist-pin bearing. Check for looseness when you reassemble the lower connecting-rod bearing on the crankshaft. If necessary, file the cap lightly until slight drag is felt on the crankshaft when the bearing is tightened.

Now's the time to think about the drive pulley. A 10″ pulley driven by a four-incher on the motor should provide the right compressor speed. If you have facilities for boring the large pulley to

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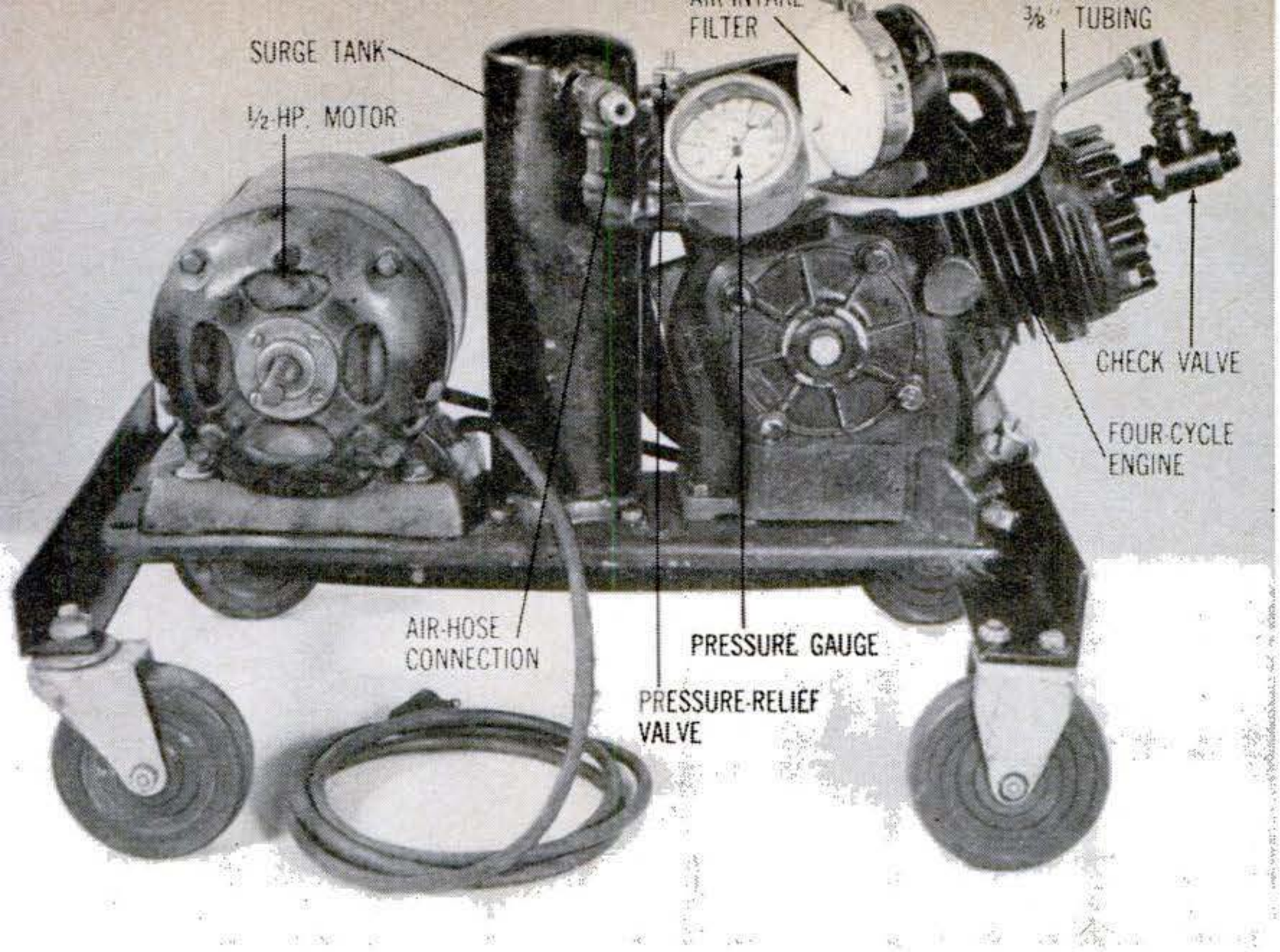
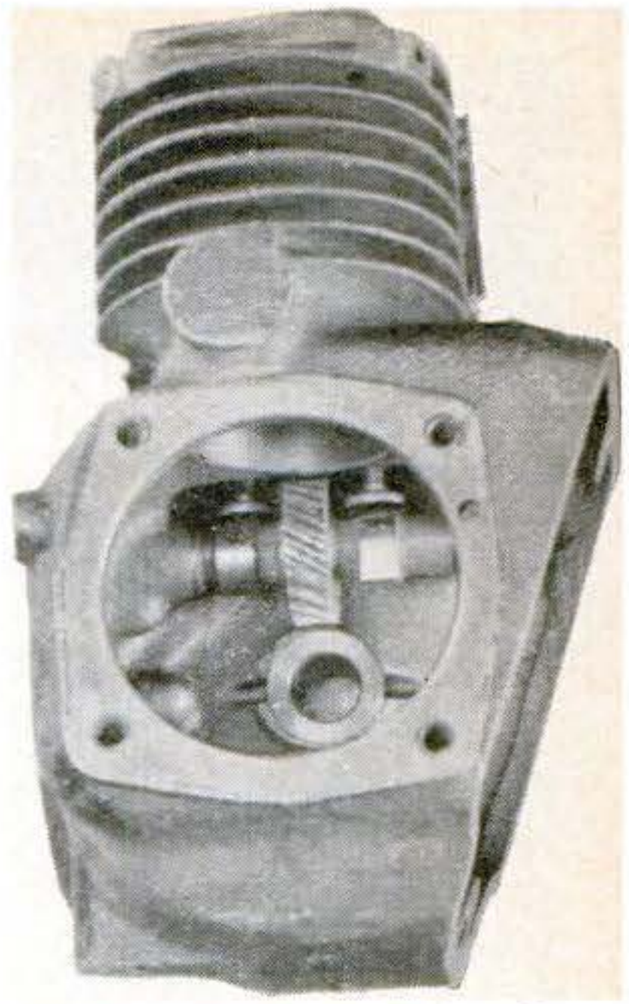




STRIP ENGINE of all parts not needed for compressing air, including camshaft (above).

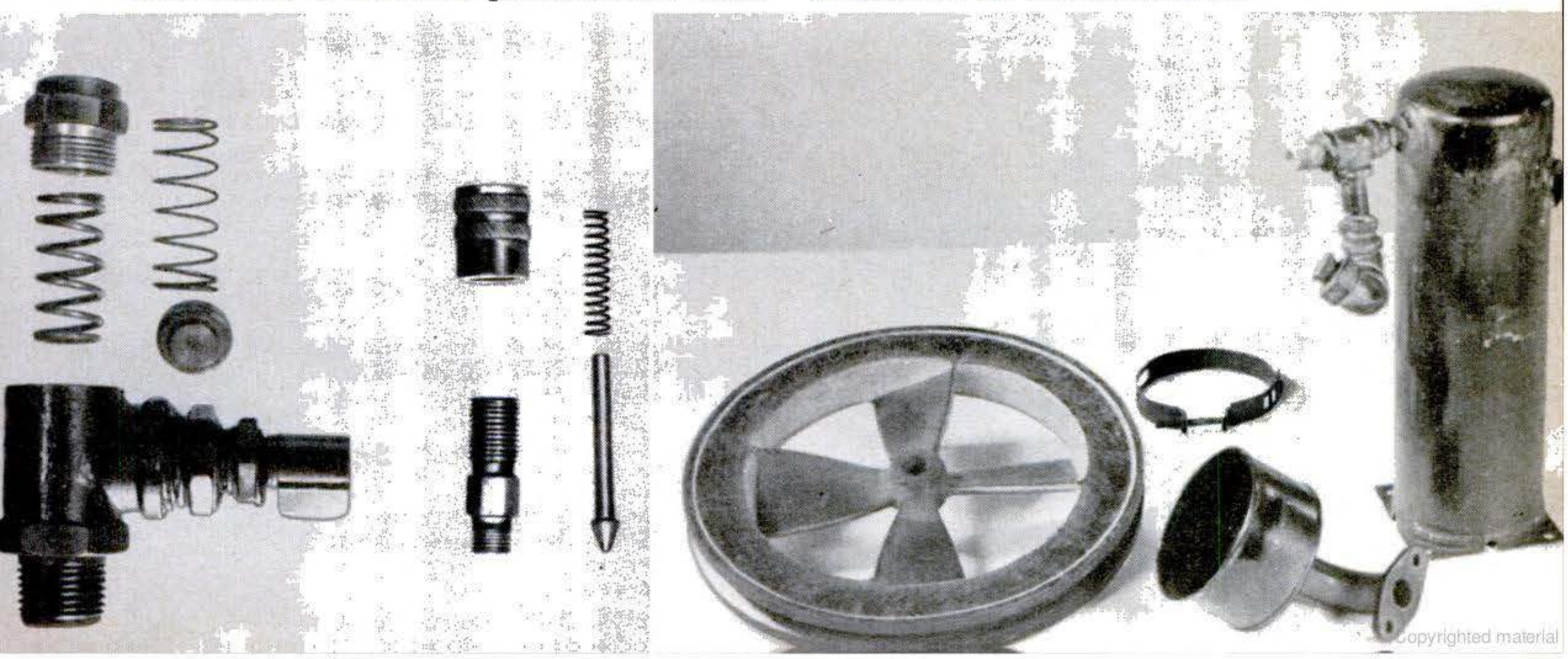
fit the tapered crankshaft end, do so. If not, it may be easier to turn the crankshaft on a small lathe so that it fits the pulley.

Install a check valve in the spark-plug hole in the cylinder head to keep air pushed out by the piston from flowing back into the cylinder. The one used was a pressure-relief valve for a home water system. Bore out the spark-plug hole, if necessary, and cut a pipe thread to fit the valve. Now you can assemble the engine and add the fittings that will make it a compressor.

To equalize pressure and take the pulse out of the air flow, a surge tank is needed. Any small surplus tank will do, or a refrigerator tank can be used as shown. Connect one tank opening to the compressor with ⅜" copper tubing. Install fittings in the other opening to support an adjustable pressure-relief valve, a pressure gauge, and a standard air-hose connector. For an air filter, bolt a tunafish can to the carburetor-manifold elbow and cover the open end of the can with gauze held in place with a hose clamp.

Mount the compressor, surge tank, and a ½-hp. motor on a small dolly for portability. The dolly shown was made of angle iron and fitted with casters from a child's crib.

TWO VALVES CONTROL AIR FLOW: Check valve (below, left) can be bought at plumbing shop. Modify it by installing lighter spring and inverting disk so metal side seals against seat. Safety valve shown is standard pressure-relief valve sold by compressor dealers. Other parts needed are 10" pulley, surge tank (right), and a tunafish can bolted on carburetor elbow. Hose clamp holds gauze or loosely woven cloth over tin can to filter the air that is drawn in.



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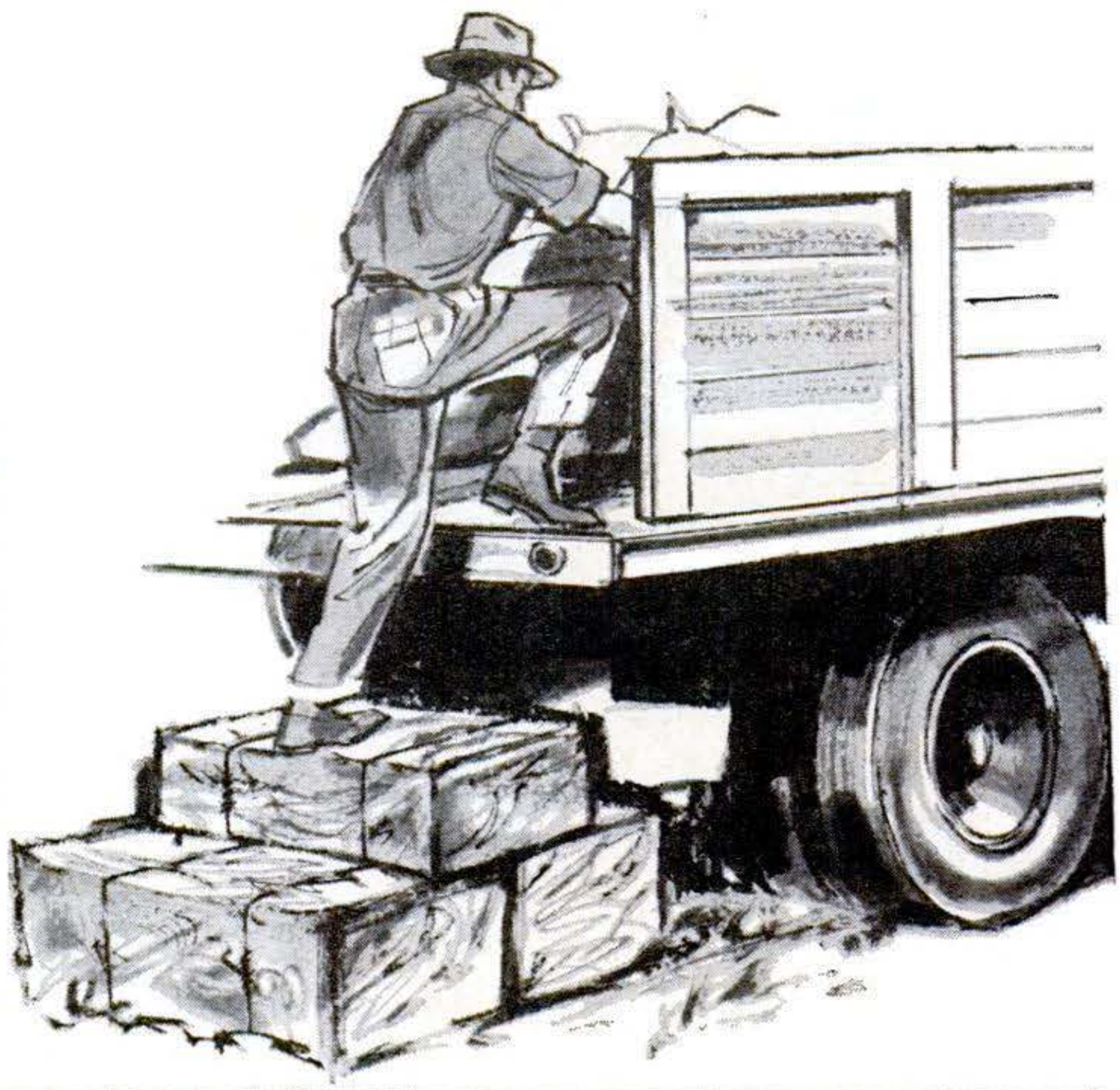
Short Cuts and Tips

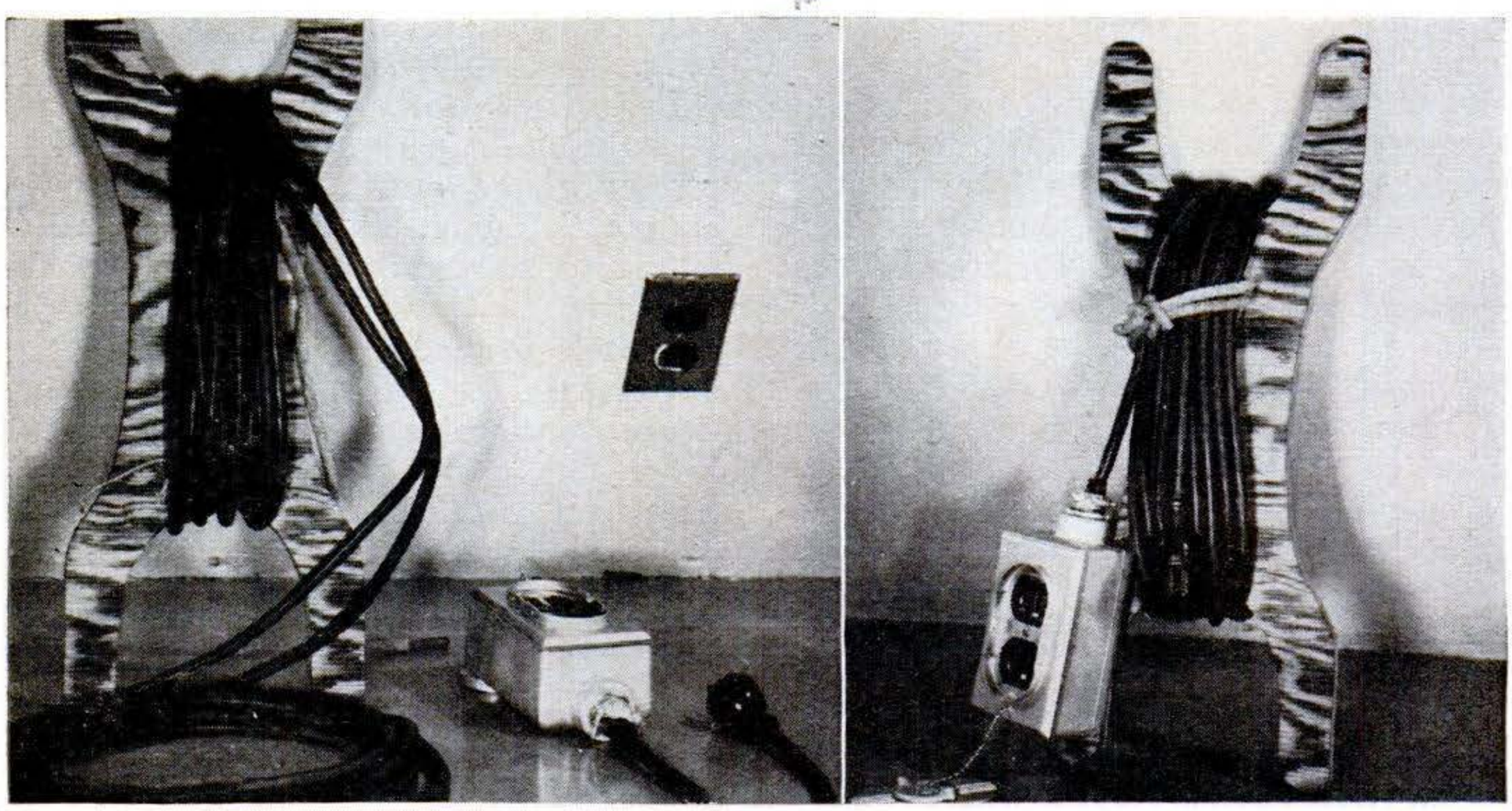
FROM PS READERS

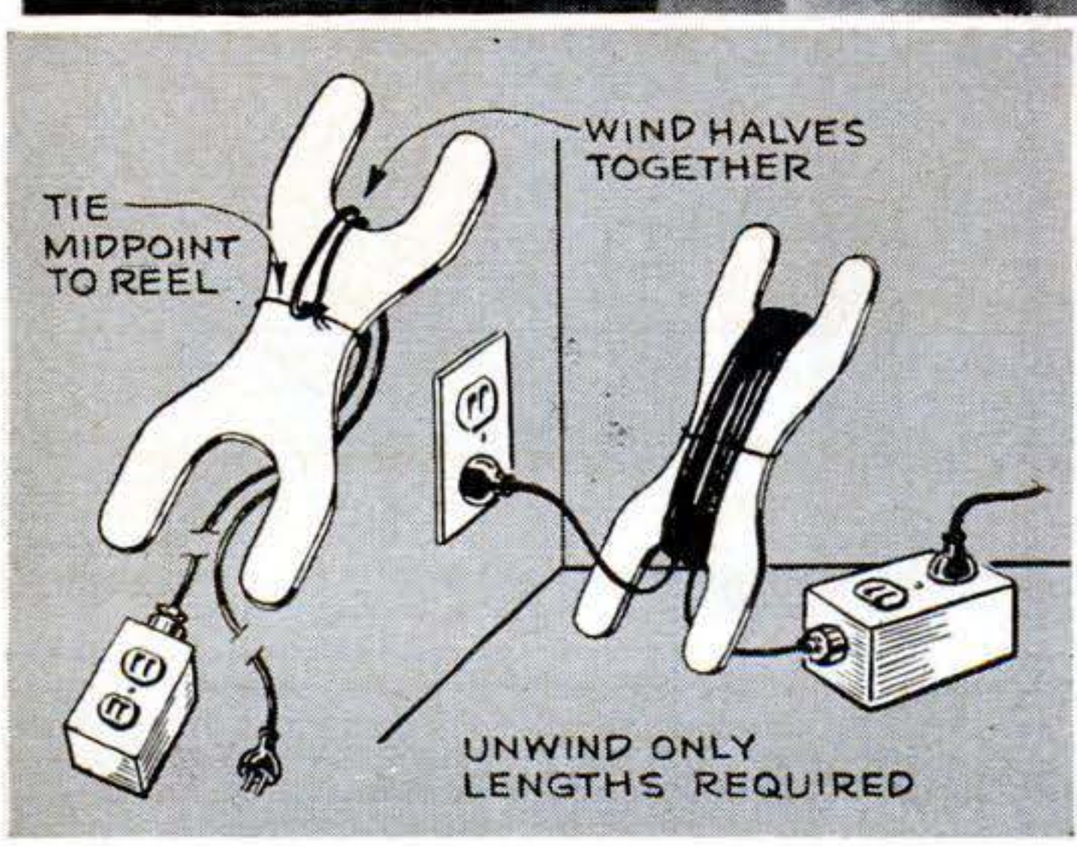
Straw Stairway for Loading Truck

ONE-MAN loading and unloading of farm trucks often requires climbing in and out with heavy burdens. The job can be done without strain if bales of hay or straw form stairs.—*G. E. Hendrickson, Argyle, Wis.*



▶▶▶THE base of a shattered light bulb can be safely turned from a socket by pressing a large cork onto the glass edges.—*Tetsuo Otsu, Vancouver, B. C.*





Reel for Extension Cord

THIS plywood reel keeps 50 feet or more of #14 rubber-covered wire in a neat coil and makes it easy to gather up after use. The version in the left photo and the sketches has a cord folded at midpoint and tied to the reel; the halves are wound parallel so that equal lengths at each end may be unwound together—to the exact extension needed. The reel in the right photo has the outlet box mounted on it so it's unwound from the plug end.—*G. F. Hengel, Wayne, N. J.*

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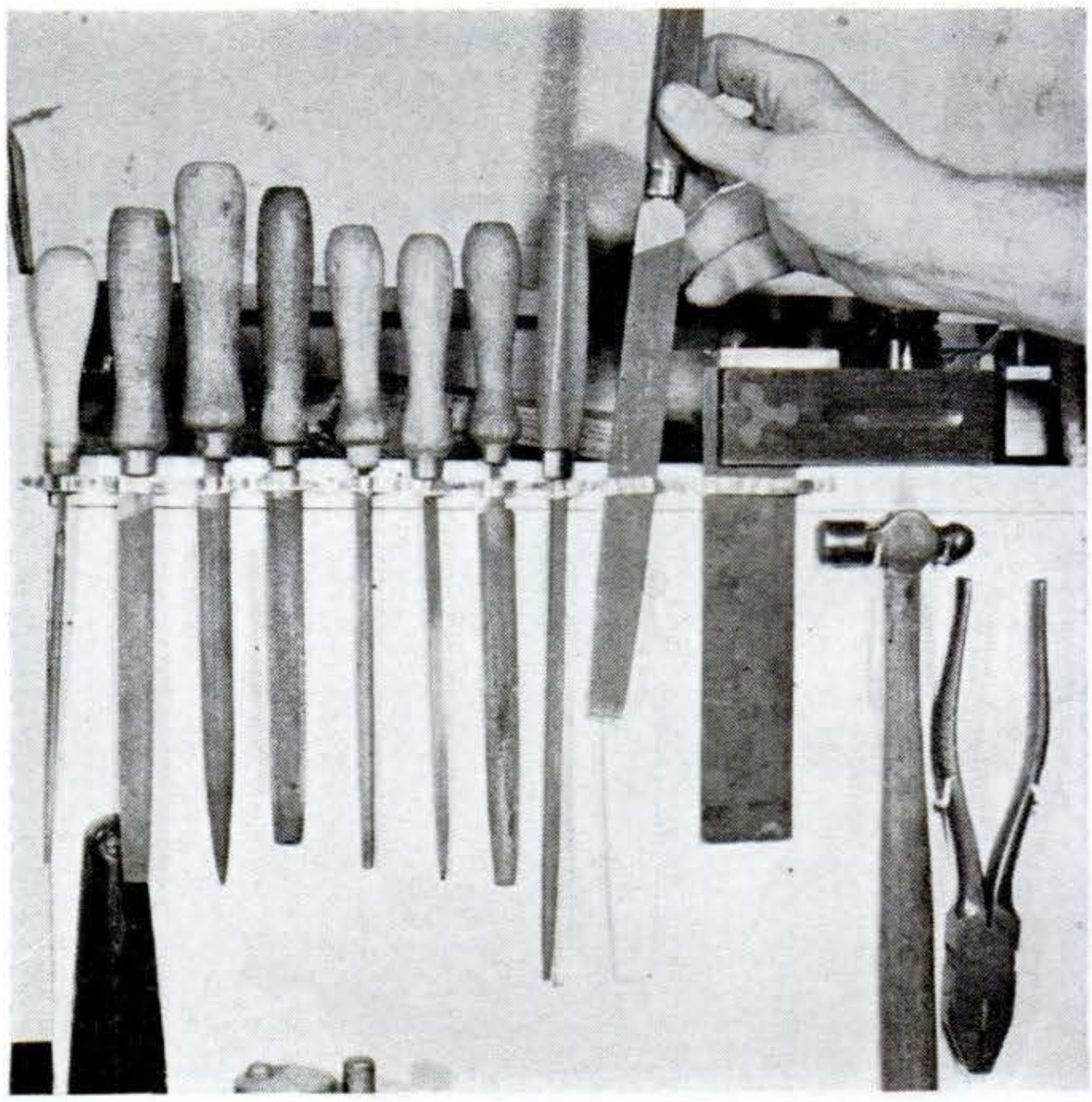
Short Cuts and Tips

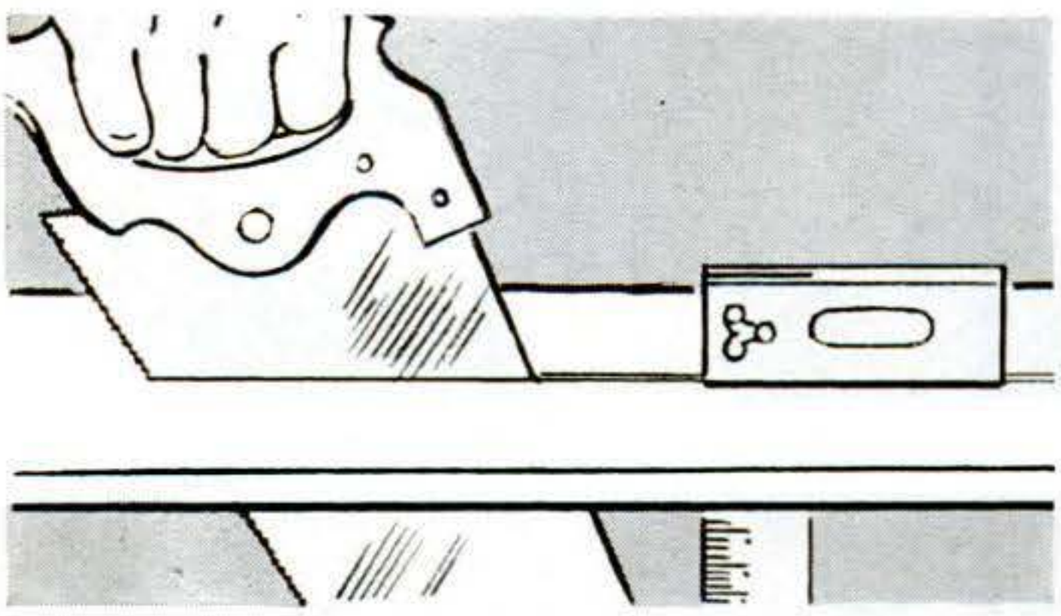
FROM PS READERS

Tin-Can Strip to Hold Tools

A FITTED tool rack can be made from the tin strip you wind on a key when you open a coffee can.

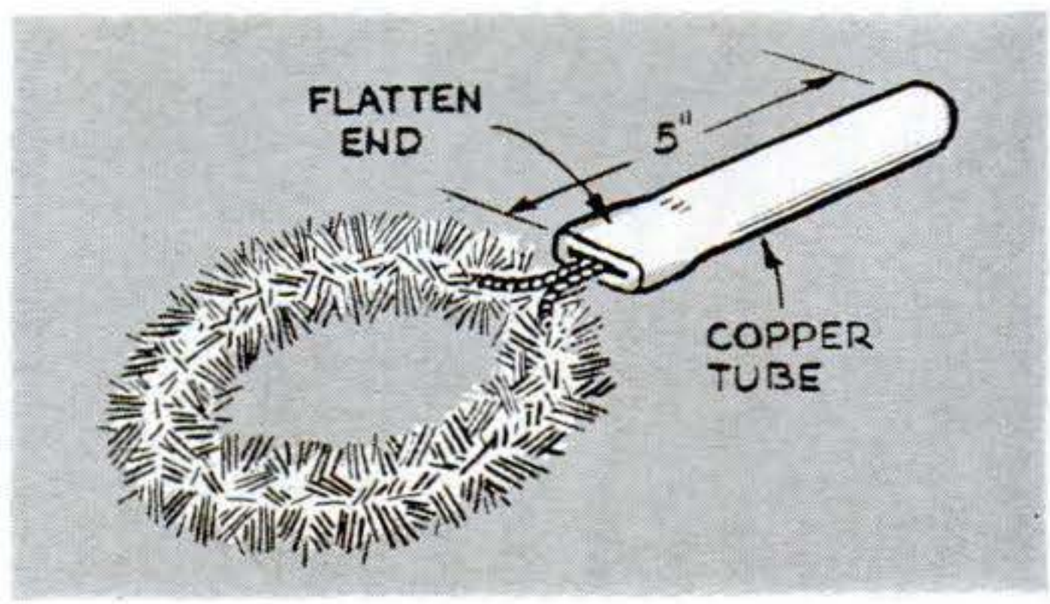
Unwind the strip, flatten it, and nail one end to a shelf edge or one-by-two tool board. Hold each tool in position and shape the tin around it. Nail the tin between the tools. Since each tool fits only its own place, number it or draw its outline on the tool board.—*H. Walton, White Plains, N.Y.*





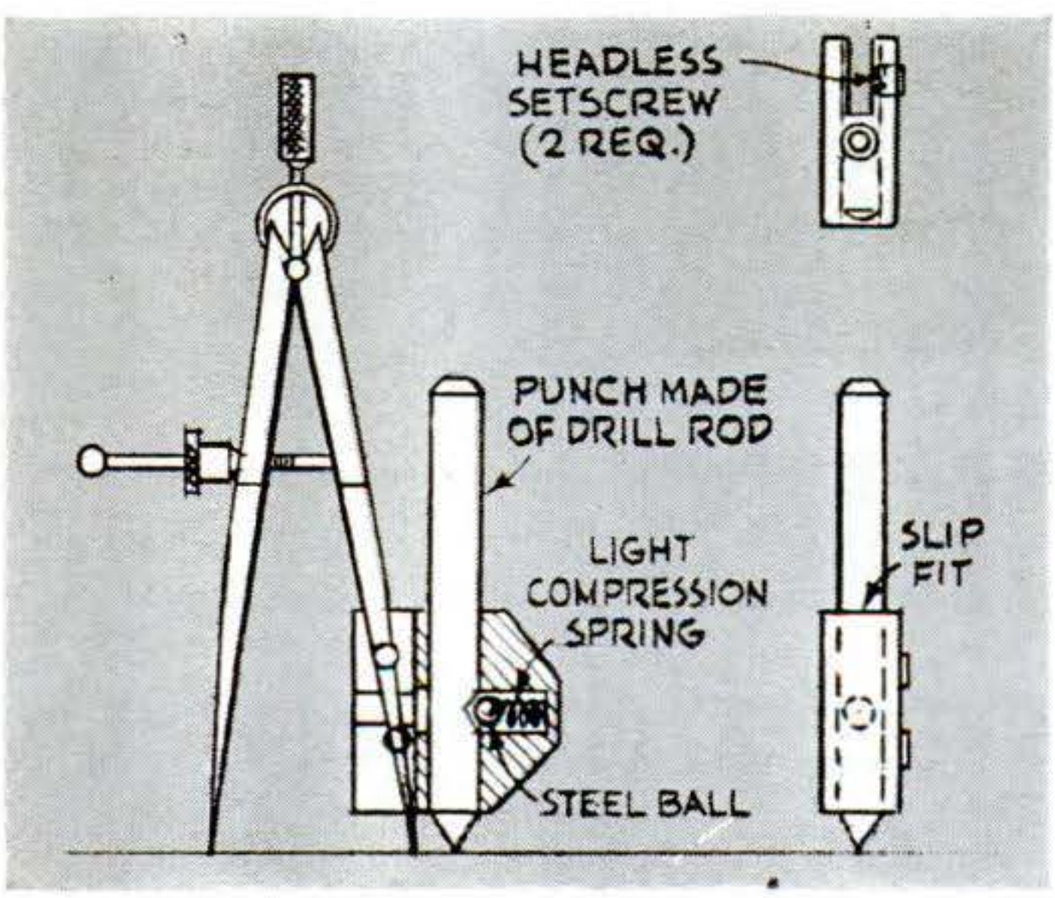
Square Keeps Saw from Binding

WHEN making a rip cut, place the blade of a try square in the saw kerf. This will keep the wood from springing together and jamming the saw blade.—*Daniel Bousha, Jackson, Mich.*



Permanent Brush Handle

FIBER brushes are likely to lose their handles. To replace the original handle I use a piece of 3/8" copper tubing, clinching it on the wire ends of the brush.—*William G. Brennan, NYC.*



Attachment Spaces Holes

THIS easily made divider attachment saves time and insures uniform hole spacing along a straight or curved line. It is made from a rectangular piece of steel and has a slot in one side to accommodate the divider leg. The hole for the punch-retaining spring is drilled crosswise before the slot is cut. When clamping the divider leg, the block should be positioned to keep the punch vertical. Be sure the prick punch slides freely. The punch is tapped with a light hammer; the marks must be enlarged later with a heavier punch.—*F. Murray, Chicago.*

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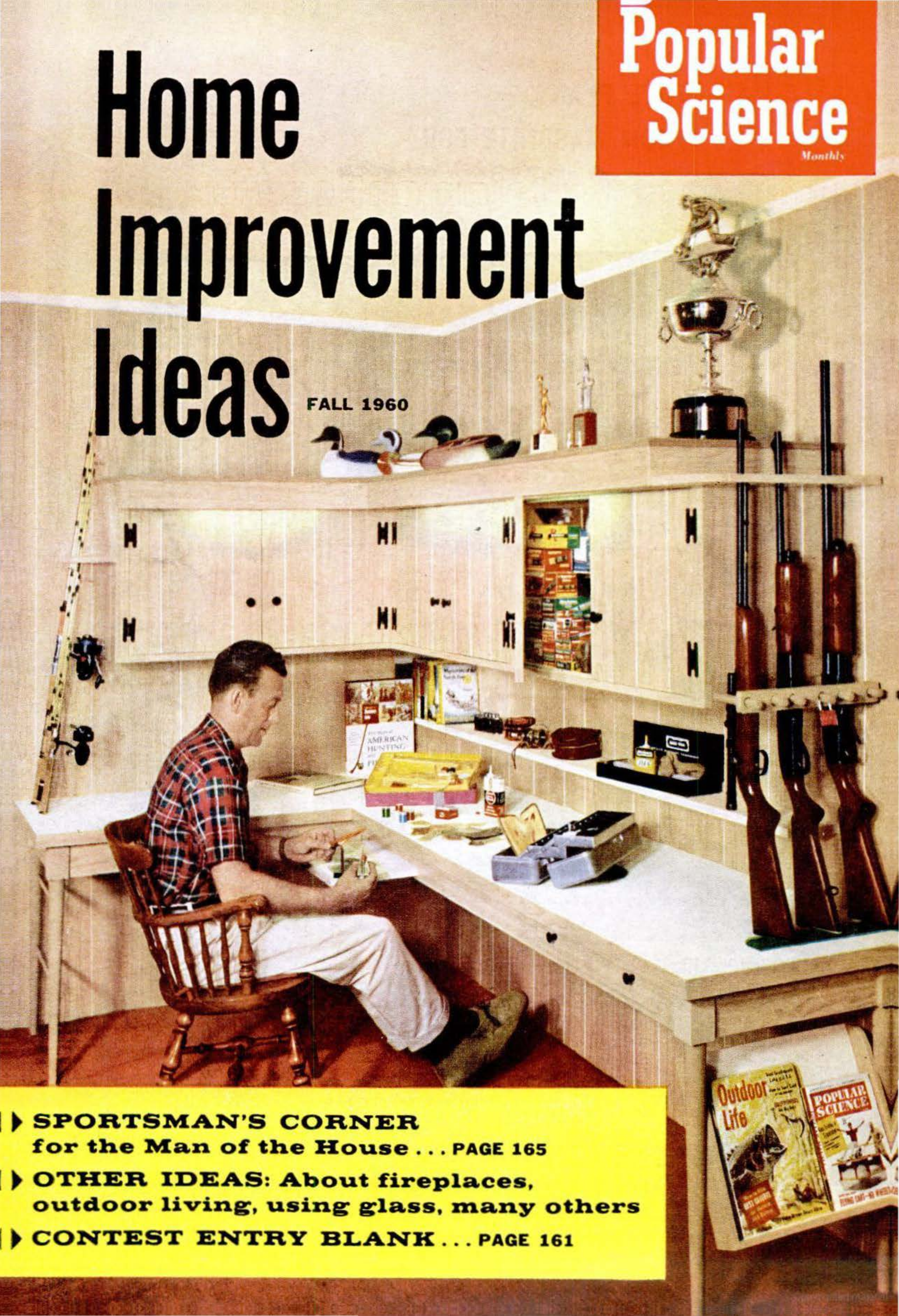
The Popular Science Monthly

Home Improvement Ideas

FALL 1960



- **SPORTSMAN'S CORNER for the Man of the House . . . PAGE 165**
- **OTHER IDEAS: About fireplaces, outdoor living, using glass, many others**
- **CONTEST ENTRY BLANK . . . PAGE 161**

FREE PLANS FROM MASONITE FOR

built-in entertainment center

What a wonderful way to divide a room...and add loads of useful fun and storage space!

And it's so easy to make. Complete plans show every detail and complete bill of materials. With easy-to-work *Masonite hardboards**, that built-in entertainment center you've wanted can now be a reality.

**Only Masonite makes hardboard by the exploded wood-chip process.*

"DRESS-UP" TIP: For added decorative beauty you can finish the walls adjacent to any built-in or create an accent wall with Masonite Royalcote cherry or walnut grained panels. They go up in easily handled 16″ wide, tongue and grooved planks and stay put—with all their good looks—for years. See **these exciting cherry panels with the exclusive patented clip application system at your nearby lumber dealer's.**

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Zone ..... *County* .....

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Easy Way to Install Ceramic Floor Tiles

YOU can now put down tiny ceramic floor tiles as easily as asphalt or vinyl tiles. The miniature 1″-by-1″ mosaics come bonded in 9″ squares of resilient rubber.

You need no mortar or grout. The rubber-backed tiles—like other types of resilient flooring—are set in mastic that you spread over the floor. Sixty-four of the tiny tiles go down every time you plop a square in place. Once down, the floor is ready to walk on.

The new tiles, called Ceramaflex, can be placed on any wood, concrete, or other reasonably flat floor above or below grade. The rubber gives them a cushion effect underfoot and lets them lie flat over irregularities. Joints are invisible.

The squares come in 12 color combinations for $1.25 to $1.70 a square foot. They can be obtained at tile dealers or through the U. S. Ceramic Tile Co., 217 4th Street N. E., Canton 2, Ohio.

Home Improvement Ideas

FALL 1960

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• • •

"Home Improvement Ideas," published as a supplement to a regular issue of "Popular Science," is devoted exclusively to the physical betterment of the average man's greatest investment—his home.

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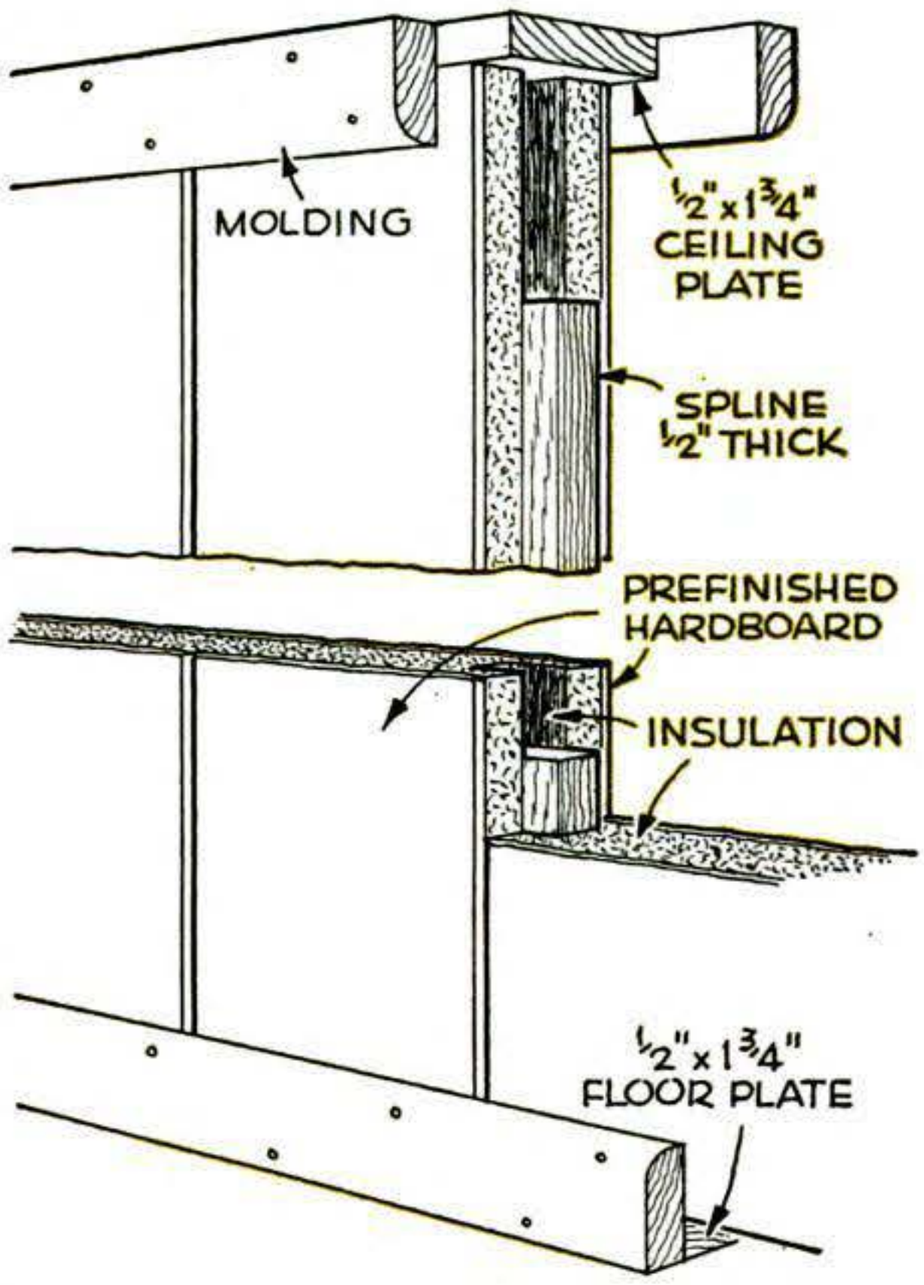
Easy Way to Put Up Walls

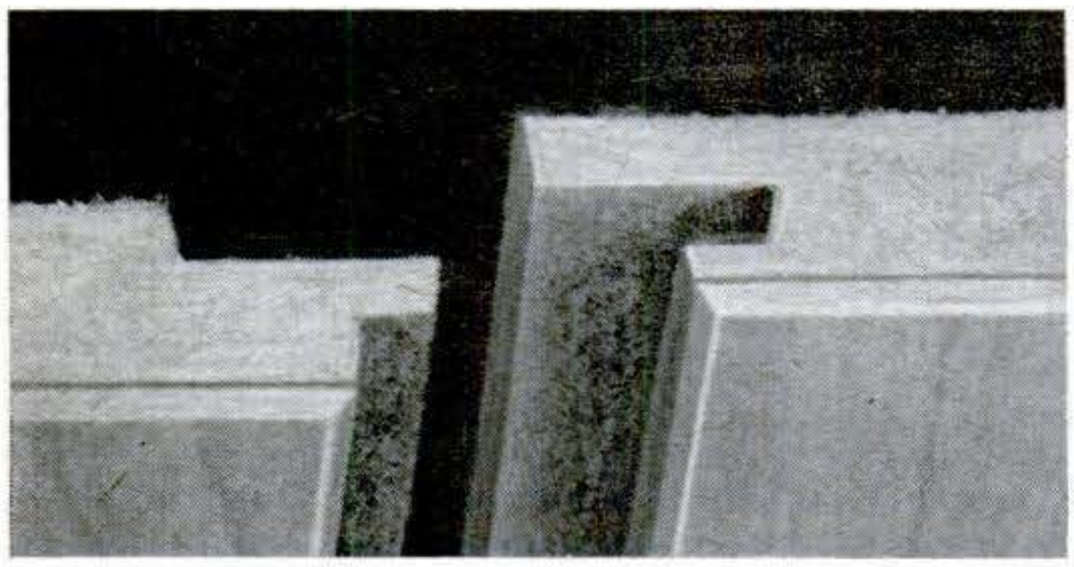


PARTITION PANELS, finished on both sides, are slipped between floor and ceiling strips. Molding forms U-shaped channels to lock the 1¾"-thick panels in place. They are joined with spline strips that lock into edge grooves, eliminating nailing.

YOU can put up a partition wall in as little as an hour with new prefab panels that fit between floor and ceiling. The panels are a 1¾"-thick sandwich with a facing of prefinished, wood-grain hardboard on each side and a core of rigid insulation board, giving you a complete wall in a single unit.

To install the panels, you first nail ½"-by-1¾" plywood strips to the floor and ceiling where you want the wall to go. Molding strips, nailed to the floor and ceiling plates, then form U-shaped channels to grip the upper and lower edges of the panels. The panels, 2′ wide and 8′ tall, are joined by ½" spline strips that slip into grooves along the edges, locking the panels together without nailing. You just slide one panel after another into the floor and ceiling channels, nail the molding to them, and the wall is complete. The floor and ceiling strips and splines come with each package of panels.

Matching wall panels also are sold in conjunction with the partition panels (see the photo at left). These are ⅝"-thick panels faced on one side with wood-grained hardboard and backed with insulation board. Two wood-grain finishes are available—dark brown and silver gray. The system, called Easy Wall Partitions, was developed by the Simpson Logging Co., 2041 Washington Building, Seattle 1, Wash. Prices are about 95 cents a square foot for the partition panels and 38 cents a square foot for the wall panels.



WALL PANELS are ⅝" thick with a single facing of hardboard and interlocking edges. Soft insulation-board backing permits panels to be stapled to furring strips without nails.

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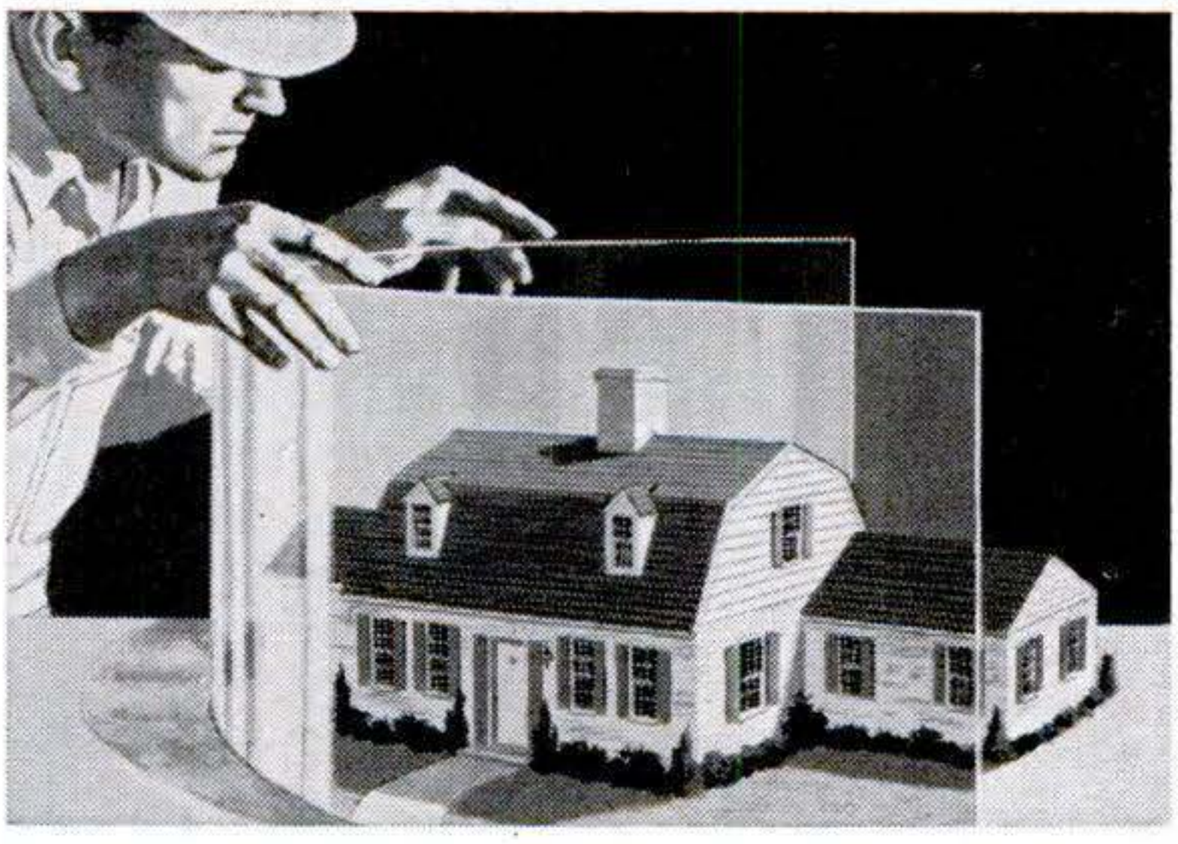
Paint blister problem 90% solved with new Du Pont LUCITE® house paint



Resists paint peeling and blistering. Moisture blistering, once the homeowner's most serious problem, has been solved. Research proves new "Lucite" Acrylic House Paint, used with Du Pont Blister-Resistant Primer over bare wood surfaces, effectively resists blistering, cracking and peeling in 90% of the cases tested. And new "Lucite" is equally good for masonry.

Outlasts ordinary paints. Tests also prove "Lucite", applied according to directions, can keep your home beautiful 50% longer than ordinary house paint. Consider today's painting costs and you'll see how it can save hundreds of dollars. Yet "Lucite" costs so little more!

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Send for booklet, "How to Get Extra Years of Beauty from Your Next House Paint Job." Du Pont Finishes Div., Dept. PS-69, Wilmington 98, Del. Or ask your Du Pont Paint Dealer. He's in the Yellow Pages.

Buy the paint that's worth the work...the beauty lasts

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Easy Way to Add Drawers

SIMPLE CABINET FRAME requires only uprights at sides to take the new plastic drawer guides. Drawers in two heights slide in a series of tracks, can be stacked in any order.

SMOOTH-FITTING drawers—the toughest job in cabinetmaking—are easy with new prefab drawers and slides. The tricky drawer slides come already molded into plastic panels that you just cement to the inside walls of a cabinet. One-piece plastic drawers are then slipped into the tracks and the job is done.

The plastic guide panels can be cemented to plywood, plaster, wallboard, concrete block—any reasonably flat surface. Each sheet is 24″ high and is divided into eight tracks 3″ apart. The drawers are all 17⅛″ deep and come in two heights—3″ and 6″—and in five widths from 16 1/16″ to 46 1/16″. There are two types. One takes wood fronts of birch or walnut; the other has a plastic front.

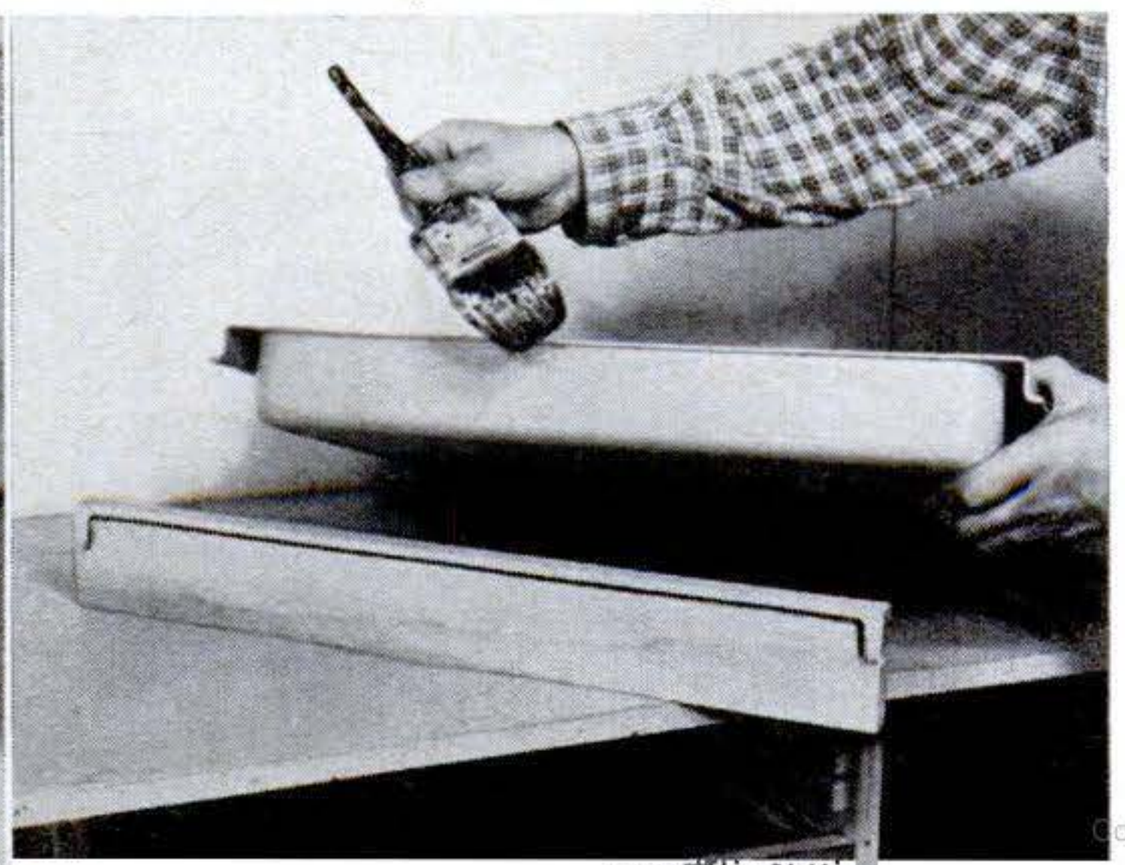
The tracks are so arranged that drawers of different heights can be combined in any order you want from top to bottom. If you want a cabinet less than 24″ high, the guide panels can be trimmed off in 3″ segments. For taller cabinets, any number of panels can be pieced together—to the ceiling if you wish.

The new system, called Stratapanel, can also be used for creating flexible arrangements in storage walls and room dividers. The drawers with built-in fronts slide in both directions, so they can be opened from either side of a wall. Adjustable shelves and pull-out counters can be inserted in the same panels.

Drawers and slides are both made of styrene, so expansion and contraction are identical. They are said never to bind or warp. Each slide panel costs $3, with drawers ranging from $4 to $10 apiece. Special contact cement comes with each package. The parts can be bought from Stratapanel dealers or from the maker, Robert A. Schless & Co., Elizabethtown, N. Y.

DRAWER GUIDES are molded into plastic sheets that can be fastened to any surface with contact cement. Sheets can be cut or pieced together to give any number of tracks you want.

WOOD DRAWER FRONTS come pregrooved to fit over plastic lip on the drawers. You just cement them on. Drawers with molded fronts are also available. The plastic is beige-colored.



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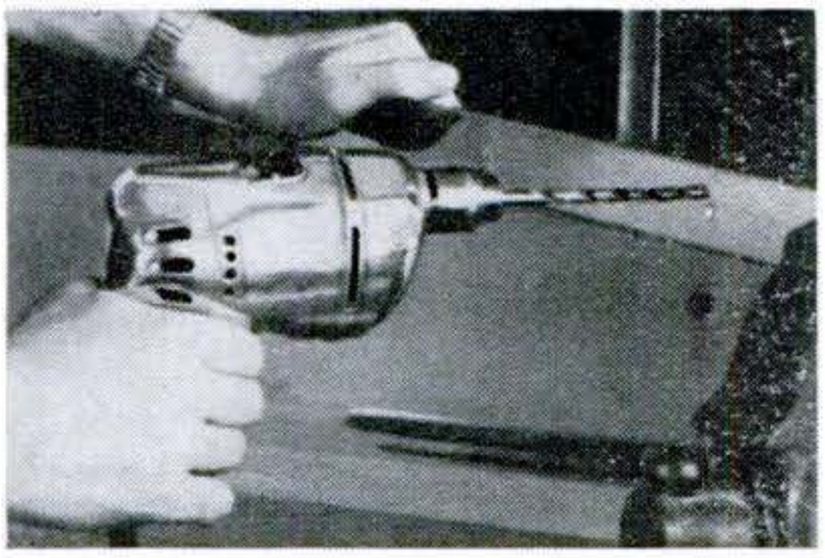

B&D ¼" Deluxe Utility Drill. *More* power for drilling and driving attachments. Compact housing—fits your hand like a glove! B&D Drills from $16.95. Attachments at $14.95.

B&D's Dustless Finishing Sander is so *dustless* you can sand and paint side by side! Long on power—light on weight. Attach to any vacuum cleaner. B&D Sanders from $29.95.

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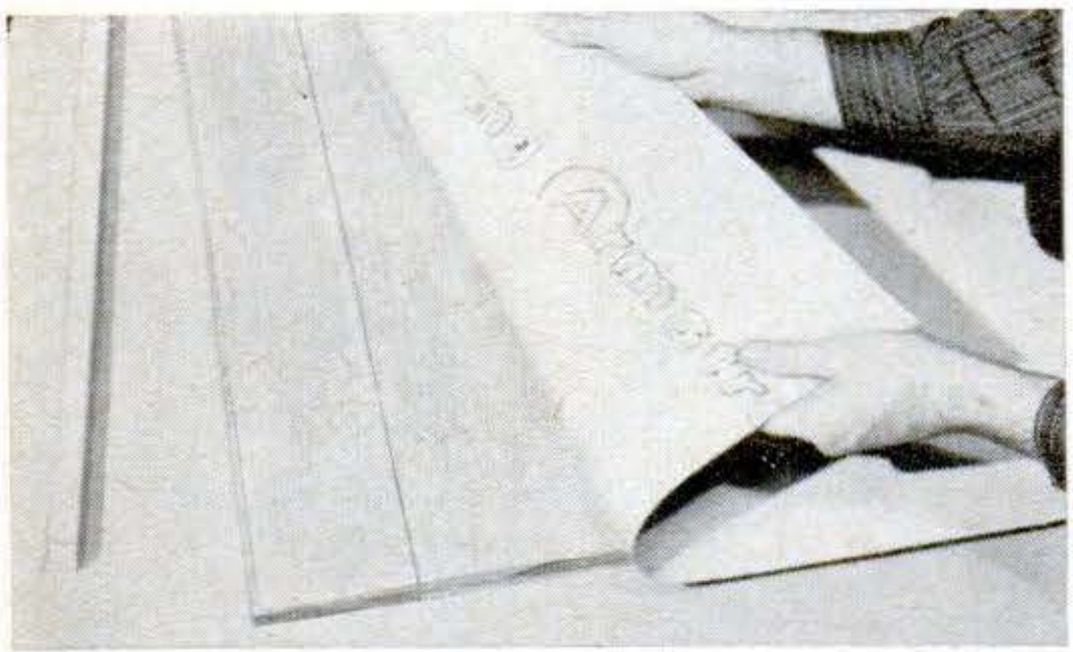
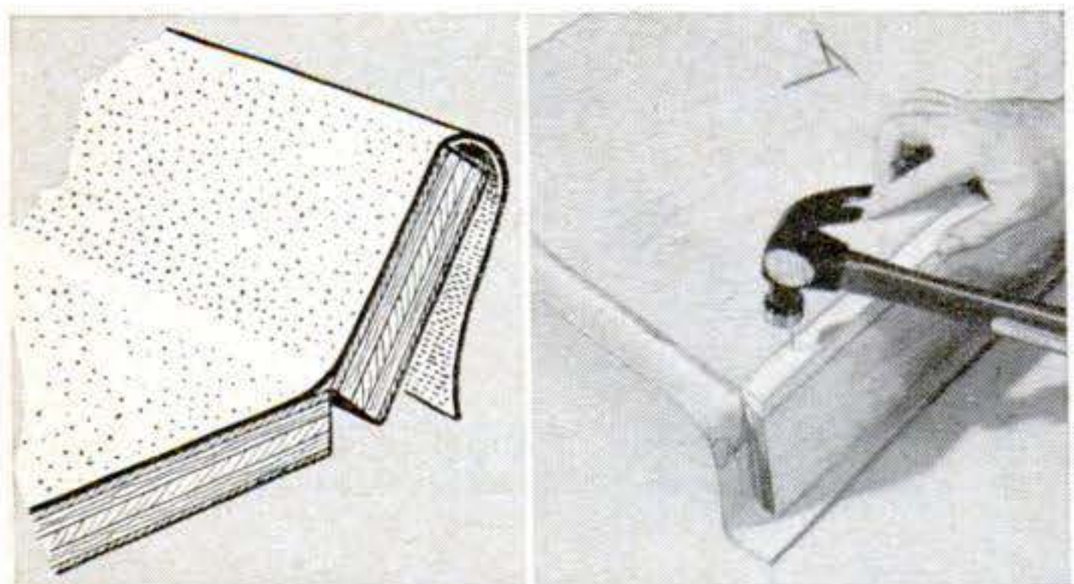
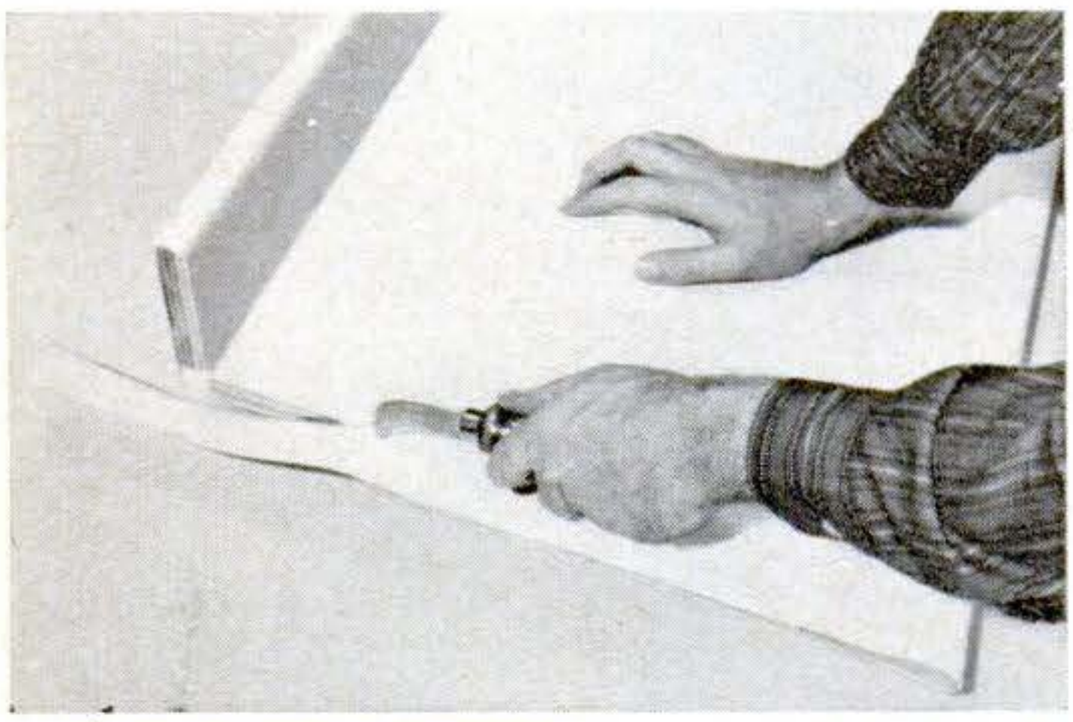
Easy Way to Cover Kitchen Counters



WHERE YOU WANT A BACKSPLASH, new method saves time and work. Counter and backsplash strip are laid out flat, side by side, brushed with cement, and covered with flexible vinyl.



BACKSPLASH IS BENT at right angles to the counter after cement has set, and a ¾"-by-¾" strip is nailed into the gap between the two boards to lock them in a rigid L shape.



ONE-PIECE COUNTER TOP is now ready to install. Vinyl, put on oversize, is now trimmed at ends as shown. At front and back edges, overlap was curved around and cemented out of sight.

A COMPLETE kitchen counter top can be covered in a few minutes by a new method devised to speed home installation. The tricky jobs of joining the counter to the backsplash and finishing off the edges are eliminated by the use of a flexible vinyl covering that bends easily around edges and corners, making trim, one-piece joints.

To make a backsplash, you lay a plywood strip for the main counter against a 4"-wide strip for the backsplash and cover both with a single piece of the flexible vinyl, using contact-bond cement. In five minutes, when the cement has set, you just bend up the backsplash strip to form a 90-degree angle and lock it in place with a filler strip nailed on in back. If you prefer a counter without a backsplash, the vinyl can be run across the top and up the wall—all the way to the ceiling if you want—in a single piece.

The method was devised by the Armstrong Cork Co., of Lancaster, Pa., for use with its new vinyl covering called Counter Corlon. The vinyl comes in rolls 30", 42", and 6' wide and can be used to cover shelves, walls, bathroom vanities, and table tops, as well as counters. The seamless, one-piece angles are watertight and easy to keep clean. Four color patterns are available—beige, white, green, and pearl. Prices are said to average less than rigid plastic toppings.

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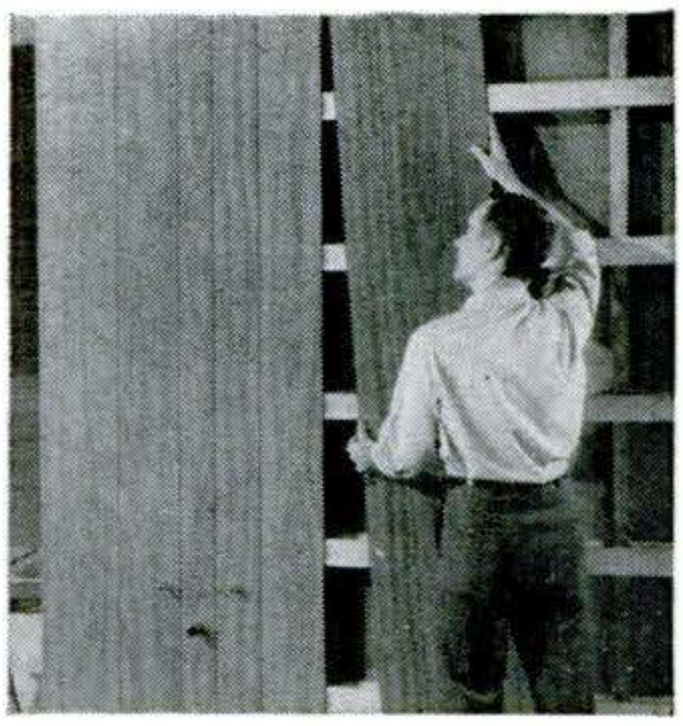

Each tongued-and-grooved plank (16" x 8' x ¼") goes up over furring strips or existing walls without muss or fuss.

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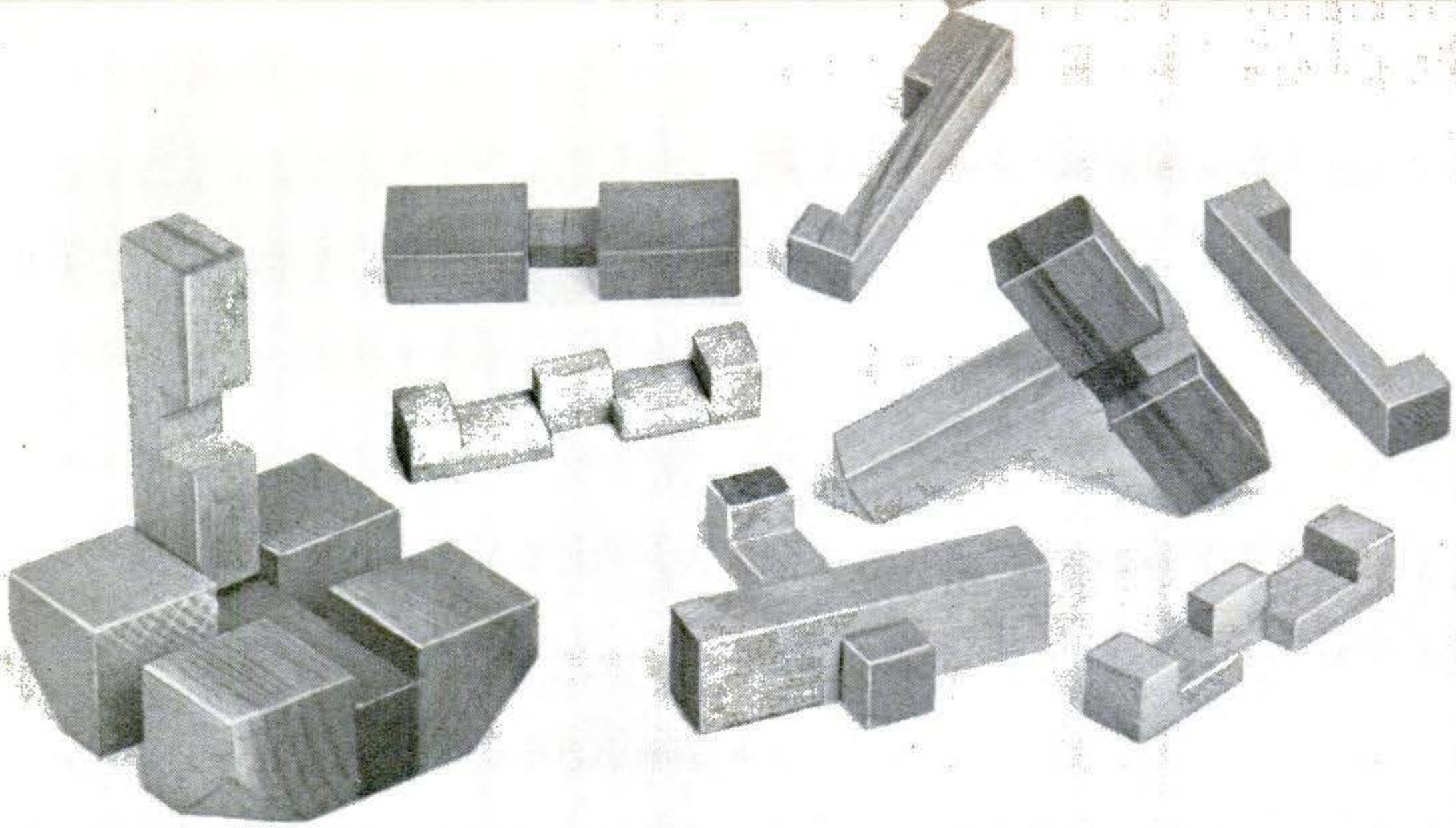

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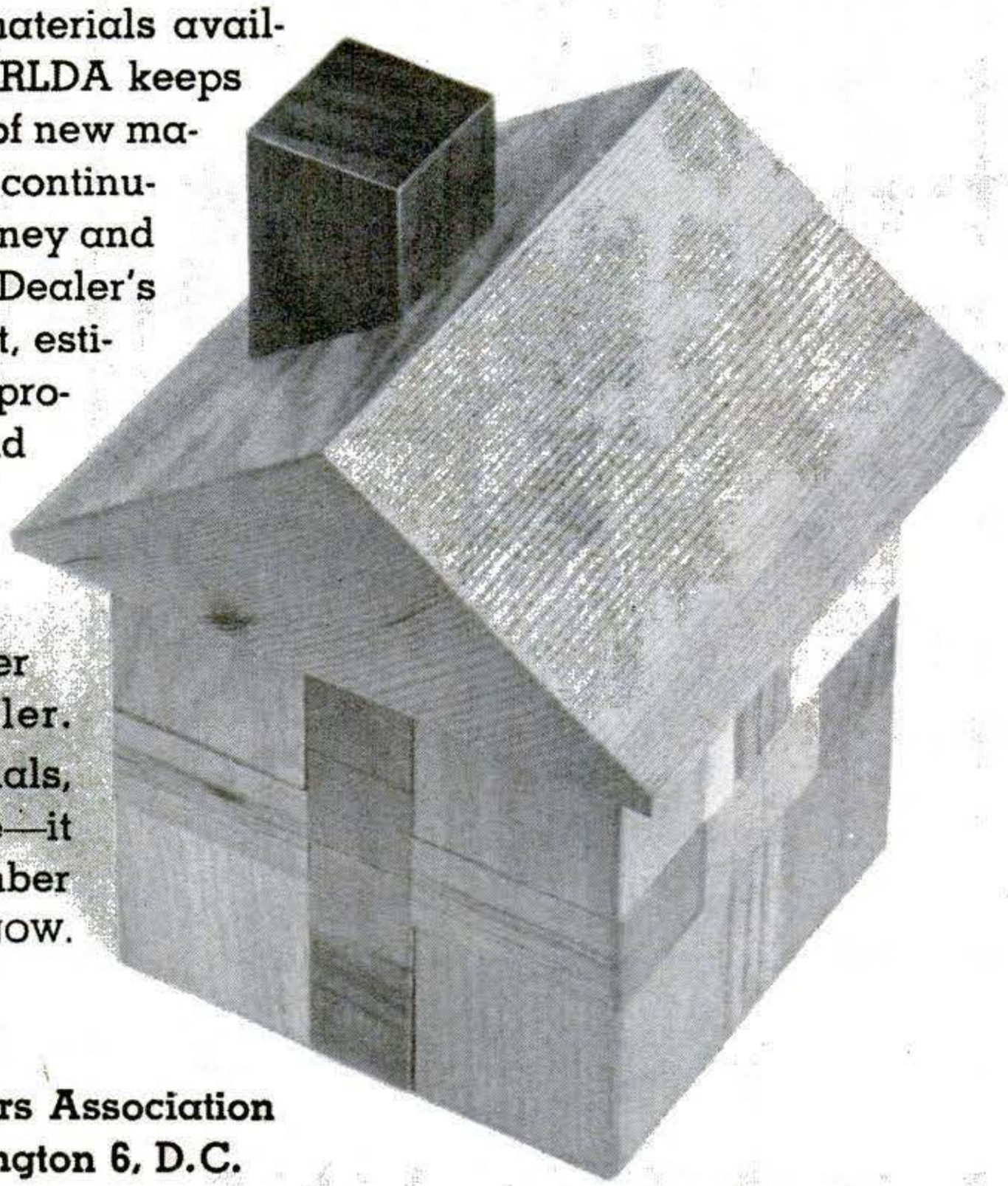

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THE 1960 POPULAR SCIENCE

"HOME IMPROVEMENT HOLIDAY" CONTEST !!

YOU CAN ENTER NOW!

CONTEST RULES:

1 Submit a brief description (not to exceed 50 words) and a photograph or sketch of any home improvement project completed on your home between December 1st, 1958 and November 30th, 1960, when the contest closes. All projects completed within the specified two year period are eligible, whether you did the job yourself or not, however, the written contest entry itself must be your own work submitted in your name. The project must have been completed while you were the occupant of the home or apartment. Use the official entry blank below. The name and address of your local Building Supply or Hardware dealer *must be filled in* on the blank or the entry is void.

2 All entries will be judged by The Bruce, Richards Corporation, an independent judging organization, according to how well the project answered a specific requirement and the project's overall inventiveness. All projects are eligible no matter how small. Writing ability and quality of the photograph or sketch are not significant.

3 Prizes will be awarded on the basis of retail value. Only one prize to a family. Trip prize must be taken before Dec. 31, 1961. Judges' decisions are final. In the event of ties, duplicate prizes will be awarded. All entries and contents become the property of Popular Science Publishing Company, and none will be returned. Winners will be notified by mail and a complete list of winners will be published in POPULAR SCIENCE Monthly.

4 This contest is open to anyone in the United States and Canada, except employees of Popular Science Publishing Co., and their families, and its advertising agency.

ENTRY BLANK

All entries must be post marked by midnight, November 30th, 1960 and received by December 9, 1960.

Remember to attach your project photograph or sketch on separate sheet of paper!

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Your Building Supply or Hardware Dealer is:

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Mail entries to:

Home Improvement Holiday Contest
Box #600 New York 46, New York

(Use separate paper with coupon attached if extra space is needed.)

(S)

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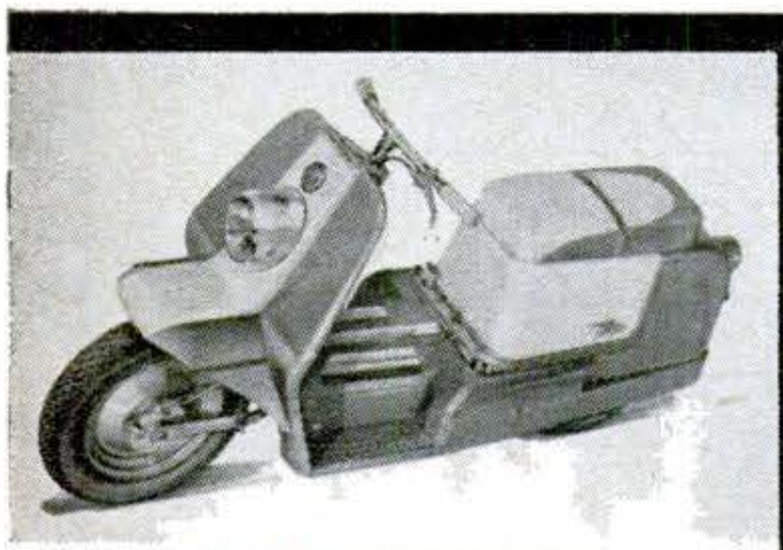

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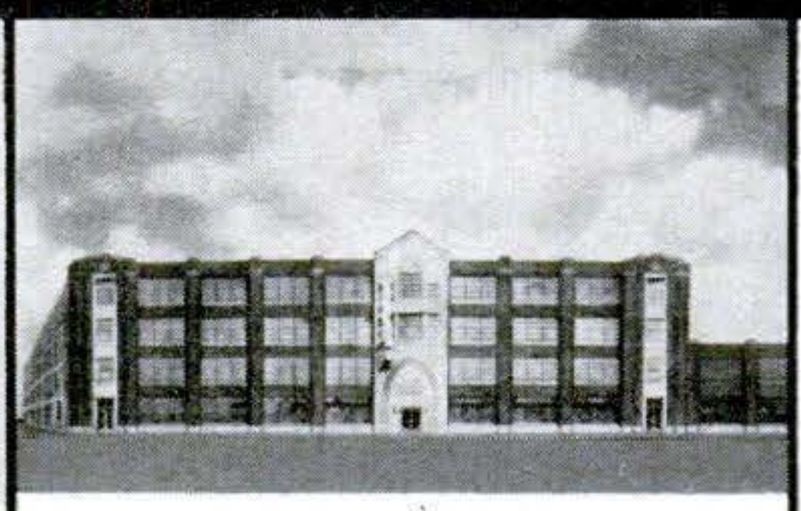

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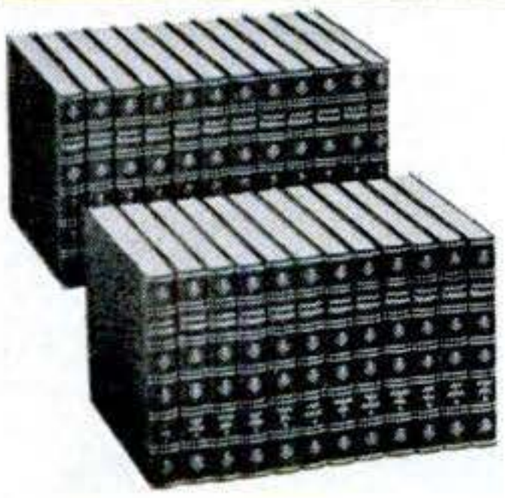

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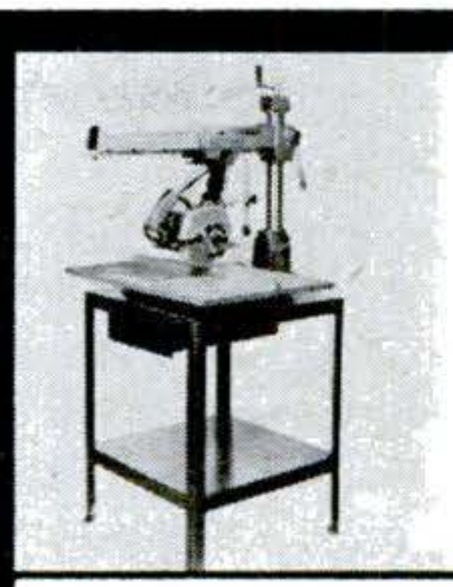

5 SHOPMATE RADIAL ARM SAWS

SHOPMATE New Radial Arm 7" Saw brings you all the cuts and accuracy of a radial saw plus the flexibility of a portable saw. It features simple, practical and accurate adjustments, with a crosscut capacity of 16" on 1" board, a rip cut capacity of 25½" outboard!

8 BLACK & DECKER ¾ H.P. HEAVY DUTY·ROUTERS

BLACK & DECKER brings you the fast, accurate, powerful ¾ H.P. Heavy-Duty Router. It's the most versatile of woodworking tools, assuring professional results. This complete kit by BLACK & DECKER features 6 of the most popular and useful bits.

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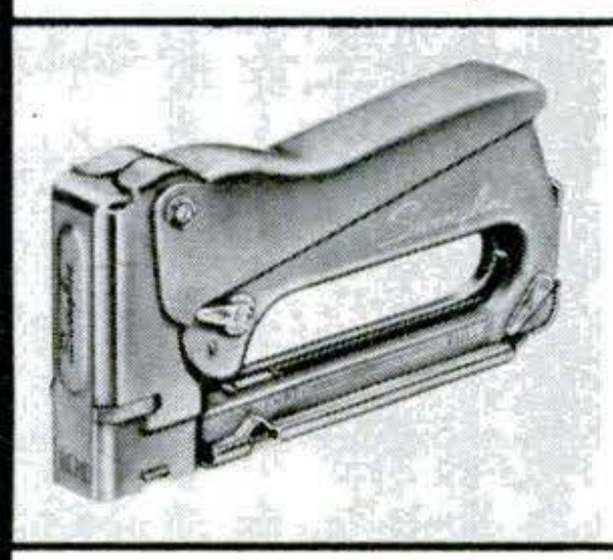
BERNZOMATIC brings you their famous Propane Torch Kit complete with an all-purpose metal carrying case. It includes cylinder, pencil burner unit, utility burner head, soldering tip, flame spreader and flint spark-lighter. It's ready for action anywhere.

20 PORTER-CABLE SANDERS

Here's the PORTER-CABLE Finishing Sander for star performance! Orbital motion lets you produce professional results on all sanding jobs. Motor-driven, exclusive gear transmission, simple abrasive changes, perfectly balanced and lightweight—just a few of the features in this PORTER-CABLE Sander.



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For the do-it-yourselfer SOUTHERN SCREW COMPANY makes-up a "package" of wood screws, sheet metal screws and stove bolts in varied sizes. It's the handyman's "help yourself" kit . . . with SOUTHERN's accent on quality.

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This Banner Tape is the first choice of artisans in every building trade. Home-owners, too, will appreciate the quality features of Lufkin Tapes. It's easy to read, easy to handle – a "must" for every craftsman.

4 SETS OF VANDERBILT TIRES

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200 RAY-O-VAC NITE HAWK HEADLITES

Your hands are always free with this RAY-O-VAC HAWK HEADLITE, complete with battery and belt carrying case. Whenever you need two hands ready, the RAY-O-VAC NITE HAWK HEADLITE becomes your indispensable companion for "the light touch".

50 SETS OF WOLVERINE BOOTS AND GLOVES

WOLVERINE presents "the perfect pair" . . . a pair of field boots, and a pair of work gloves. The WOLVERINE boots feature lightweight, waterproof construction . . . the gloves have built-in WOLVERINE wear-ability.

25 MILLERS FALLS #1144 Nylon Safe-T-Drills

An all new shock-proof drill housed in rugged DuPont Nylon...for modern all around use. Light weight—plenty of high speed power for all drill work.

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STANDARDIZE 100% ON SOUTHERN FASTENERS

At home or in school, tomorrow's craftsman soon learns the value of using USA-made tools and components. He is quick to recognize that dependable quality is as important as the know-how required.

Whether you are instructing your son, your neighbor or your students in the fine art of craftsmanship, be sure you have on hand the right size Southern screws to do the right job. Stock up now on each of the popular sizes, head styles and finishes you need. Be sure to specify "Southern Screws" in the tough, soil-resistant boxes bearing the copyrighted "EZ to C©" label. Remember: only a screw holds like a screw, so standardize 100% on Southern screws. Buy 'em by the box instead of the dab,—you'll save time and money!

Sold at leading retail lumber dealers and hardware stores.

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Sportsman's Corner

for the man of the house

HERE'S a new concept in home built-ins—a sportsman's corner that stores and displays all the trappings of a hunter-fisherman. It can be placed attractively in any room in the house. For the first time, in this POPULAR SCIENCE design, you have a place where you can keep valuable equipment and work on it at the same time.

The sportsman's corner was designed by hunting and fishing experts to meet the needs of outdoorsmen and styled by furniture experts to satisfy the requirements of the home. You don't have to store highly prized gear in a damp cellar or have a separate room to show it off in. The slim built-in can be tucked into the corner of a living room, dining room, playroom, even a bedroom.

Rods and guns are held in handsome display racks. Reels, tackle, ammunition, and other gear are hidden in cabinets. The long table provides, in effect, an upstairs workshop that will give you hours of pleasure on between-outings jobs like fly tieing, rod winding, reel oiling, and gun

A DEN IN A CORNER, this handsome built-in provides a place to work, safe storage for your prized equipment (and in view where you can show it off), and a rack for your favorite magazines. Fishhooks, knives, and ammunition can be locked away, out of reach of mischievous children.

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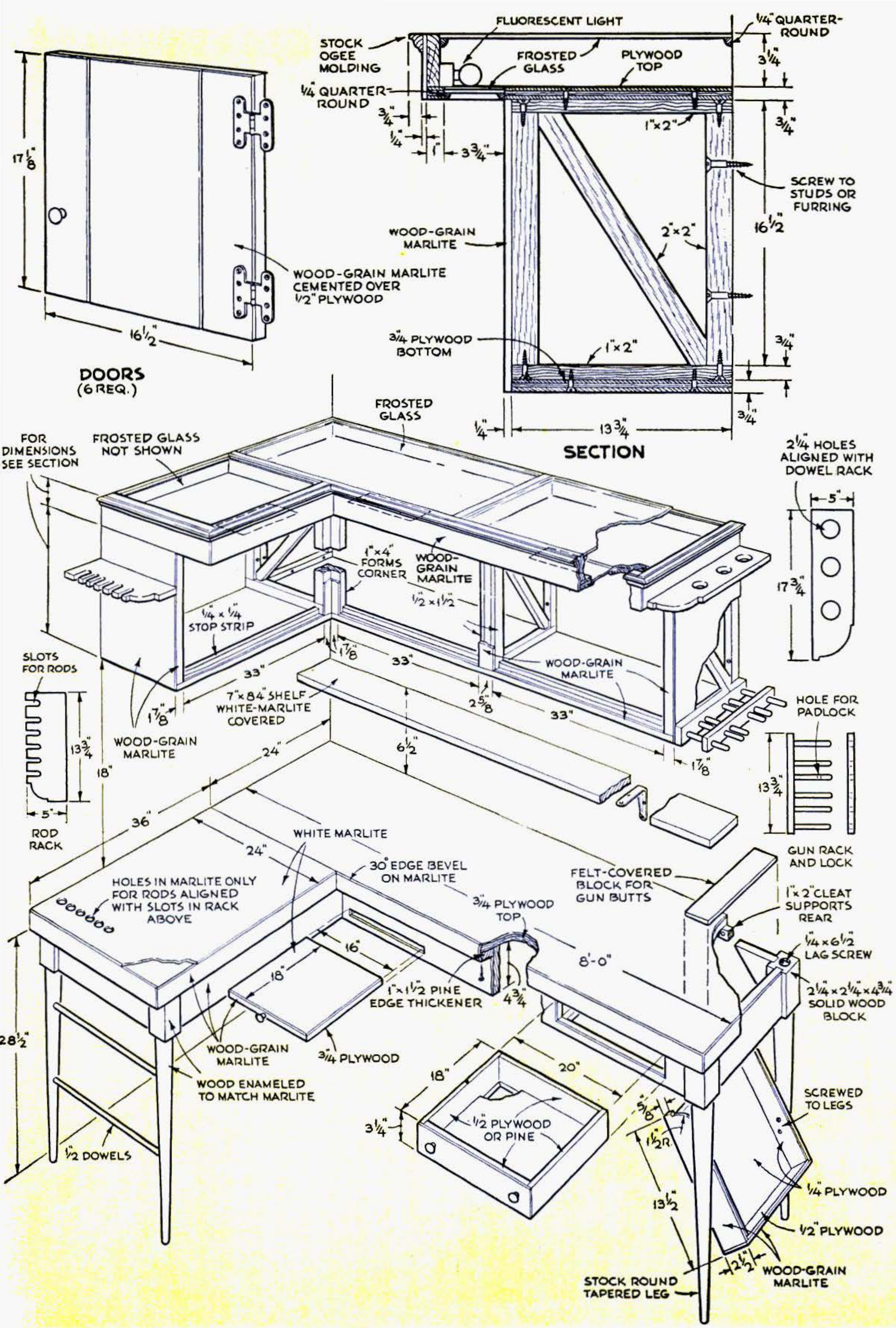
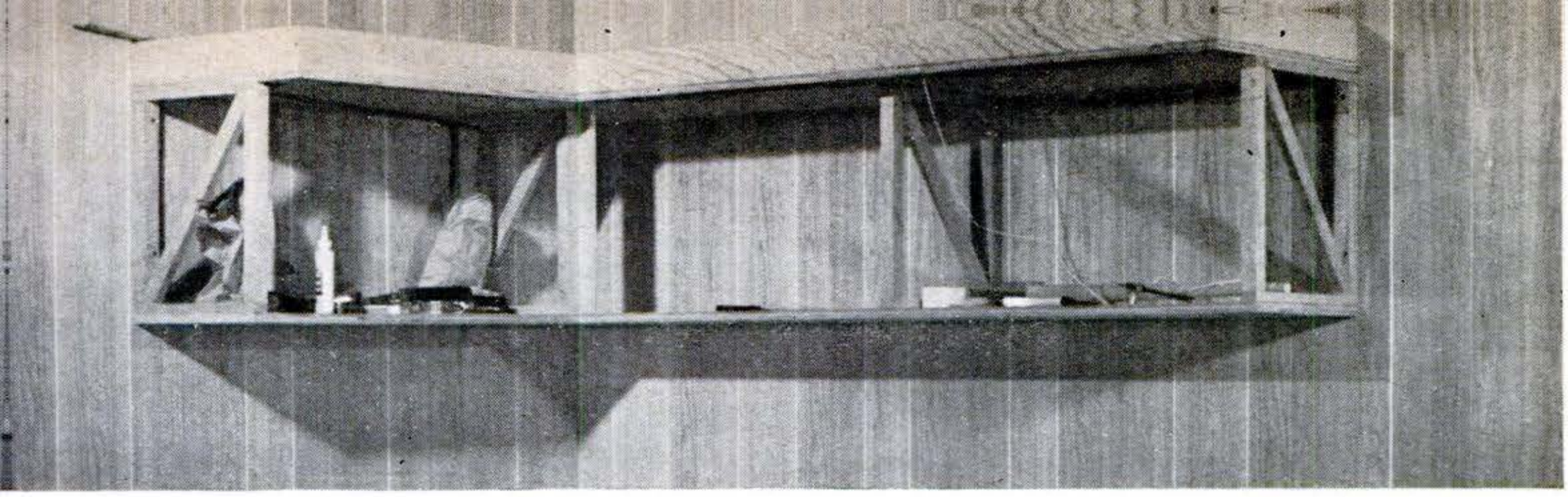

DOORS
(6 REQ.)
17 1/8"
16 1/2"
WOOD-GRAIN MARLITE CEMENTED OVER 1/2" PLYWOOD
SECTION
FLUORESCENT LIGHT
STOCK OGEE MOLDING
1/4" QUARTER-ROUND
FROSTED GLASS
PLYWOOD TOP
1"×2"
SCREW TO STUDS OR FURRING
WOOD-GRAIN MARLITE
2"×2"
3/4" PLYWOOD BOTTOM
13 3/4"
FROSTED GLASS
FOR DIMENSIONS SEE SECTION
FROSTED GLASS NOT SHOWN
2 1/4" HOLES ALIGNED WITH DOWEL RACK
5"
17 3/4"
1"×4" FORMS CORNER
WOOD-GRAIN MARLITE
1/2"×1 1/2"
1/4"×1/4" STOP STRIP
SLOTS FOR RODS
33"
7"×84" SHELF WHITE-MARLITE COVERED
WOOD-GRAIN MARLITE
HOLE FOR PADLOCK
13 3/4"
18"
24"
6 1/2"
36"
5"
ROD RACK
WHITE MARLITE
30° EDGE BEVEL ON MARLITE
GUN RACK AND LOCK
FELT-COVERED BLOCK FOR GUN BUTTS
HOLES IN MARLITE ONLY FOR RODS ALIGNED WITH SLOTS IN RACK ABOVE
3/4" PLYWOOD TOP
1"×2" CLEAT SUPPORTS REAR
1/4"×6 1/2" LAG SCREW
8'-0"
16"
18"
1"×1 1/2" PINE EDGE THICKENER
4 3/4"
2 1/4"×2 1/4"×4 3/4" SOLID WOOD BLOCK
28 1/2"
WOOD-GRAIN MARLITE
3/4" PLYWOOD
WOOD ENAMELED TO MATCH MARLITE
20"
SCREWED TO LEGS
3 1/4"
1/2" PLYWOOD OR PINE
1/2 DOWELS
1/4" PLYWOOD
13 1/2"
1/2" PLYWOOD
WOOD-GRAIN MARLITE
STOCK ROUND TAPERED LEG



SKELETON OF TWO-BY-TWOS and plywood makes a rigid frame for the skin of hardboard with a wood-grain finish. Five identical frames (two are in corner) are screwed to the wall.

cleaning. There's good lighting, too.

The corner is based on the flexible-storage principle of kitchen cupboards, but without their stark look. The cabinets can be fitted out to suit your own equipment. The two-level design gets a lot in a small space without appearing bulky. There's even a slide-out shelf, like a kitchen cutting board, for fly tieing and other jobs where you may want to pin jigs to the wood.

Construction is simple. Five identical wood frames are hung on the wall to form the cabinets. A separate legged frame supports the table top.

Both cabinets and table are covered with plastic-surfaced hardboard—a rich wood grain for the cabinets and a glossy white for the work surface. The hardboard, called Marlite, comes prefinished—you just glue it on and the job is done. Drop oil or grease on it, and a swipe with a cloth wipes it off.

A built-in light box at the top shines two ways—upward through frosted glass to illuminate trophies and other objects, downward to serve as a work light. The style of the structure is traditional, but the clean, simple lines blend with any setting.

Another ingenious trick transforms ordinary round, store-bought legs into a traditional design by pinning square blocks on top. Remove the studs that come in the legs and fasten on the blocks with lag screws. Trim the legs, after attaching blocks, to 29¼″ length.

Hanging the cabinets. On an existing wall, screw cleats to the studs above and below the cabinet frames. On a new wall, place furring strips so you can screw into them. You can panel the wall with matching wood-grained hardboard.

A three-sided plywood frame at the top forms the light box, with molding

CONTINUED

FACE DOOR OPENINGS with strips of wood-grain hardboard to match doors. Center frame on the long cabinet must be made wider to accommodate hinges for doors on each side. Glue ½″ strips to the frame, then cover with hardboard.

ALUMINUM PAINT will turn the top of the wall cabinet into a huge reflector. Covered with frosted glass, it becomes a dramatic display place for trophies and souveniers. Openings also throw light downward onto the table.

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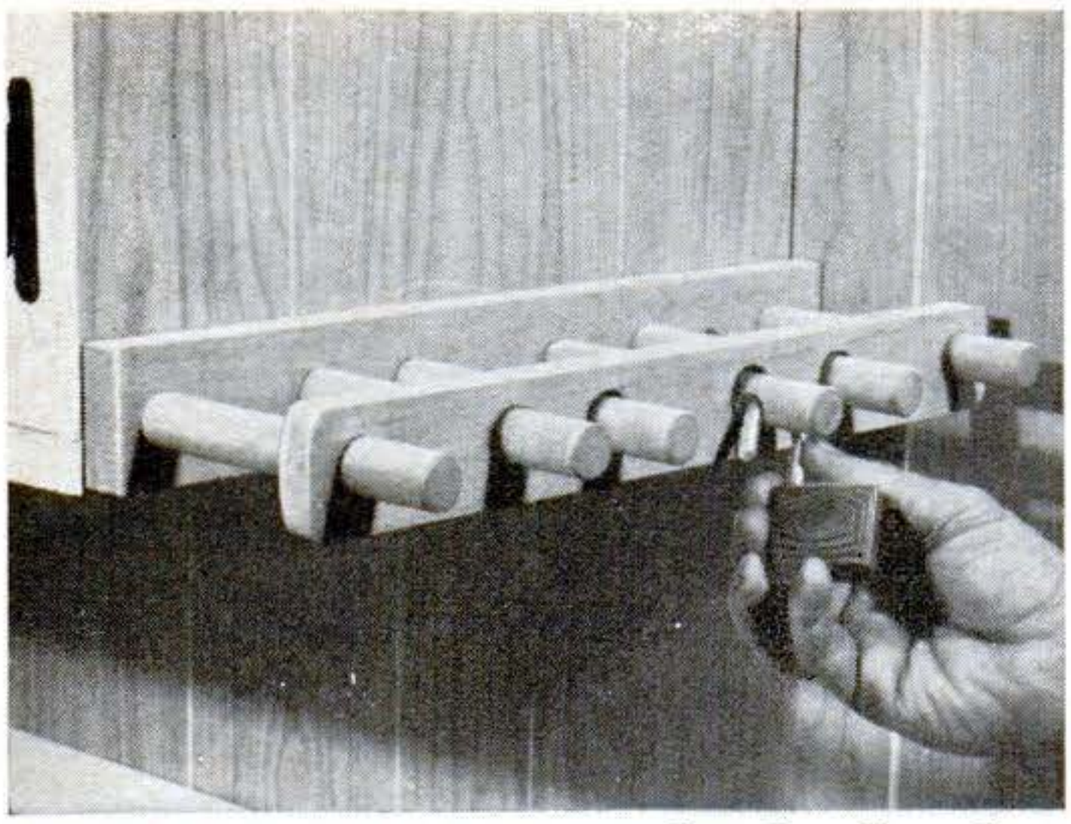


SIMPLE GUN LOCK is a wooden bar bored to slide over heavy dowels that separate guns. A padlock goes through a hole in one dowel. Barrels are inserted in holes in upper bracket.

THE MARSH WALL PRODUCTS COMPANY has made separate working plans available for this novel home-improvement project. If you like the convenience of working with such plans, address a postcard asking for the Sportsman's Corner plans to Marsh Wall Products, Dept. PR-3, Dover, Ohio.

SQUARE BLOCKS bolted to tapered legs transform them into traditional legs. Groove the blocks on two sides to fit ends of aprons at front and sides and triangular braces at rear (below). Stretchers on legs at far right below were removed and magazine rack added.

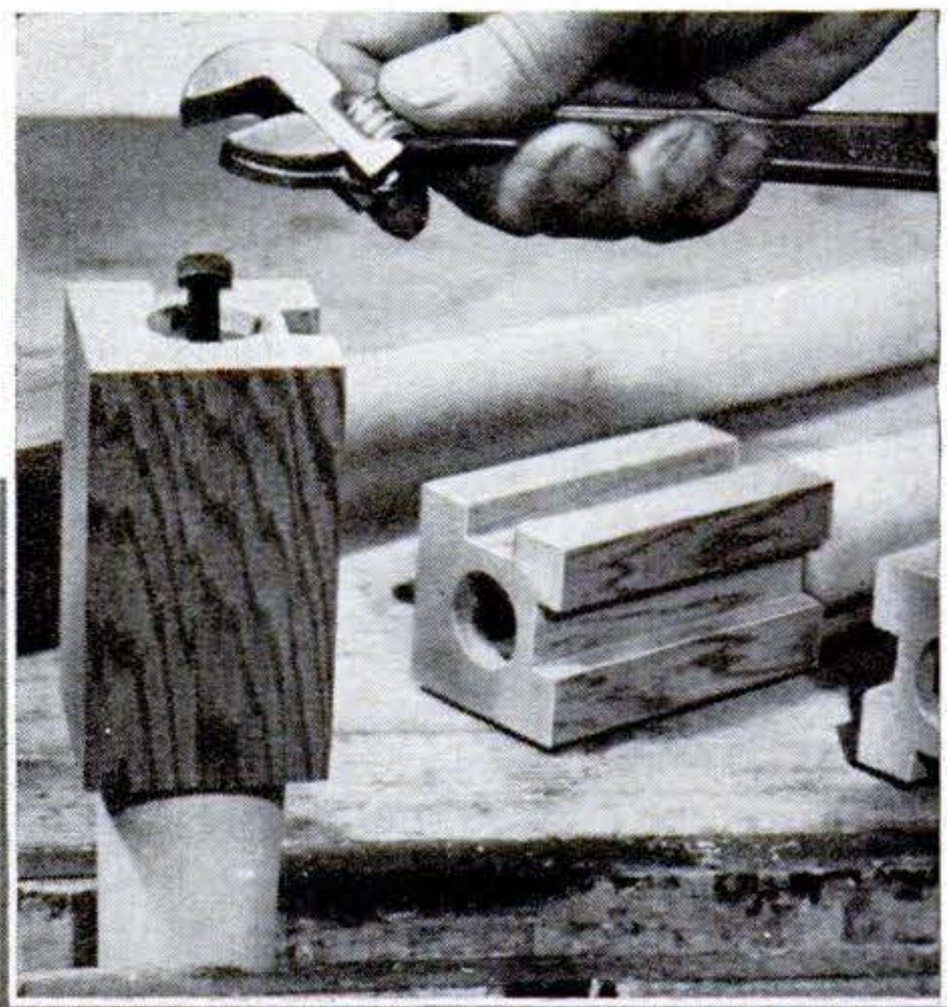
tacked inside to support the glass. Wiring is simplified if you buy prewired, plug-in fluorescent fixtures.

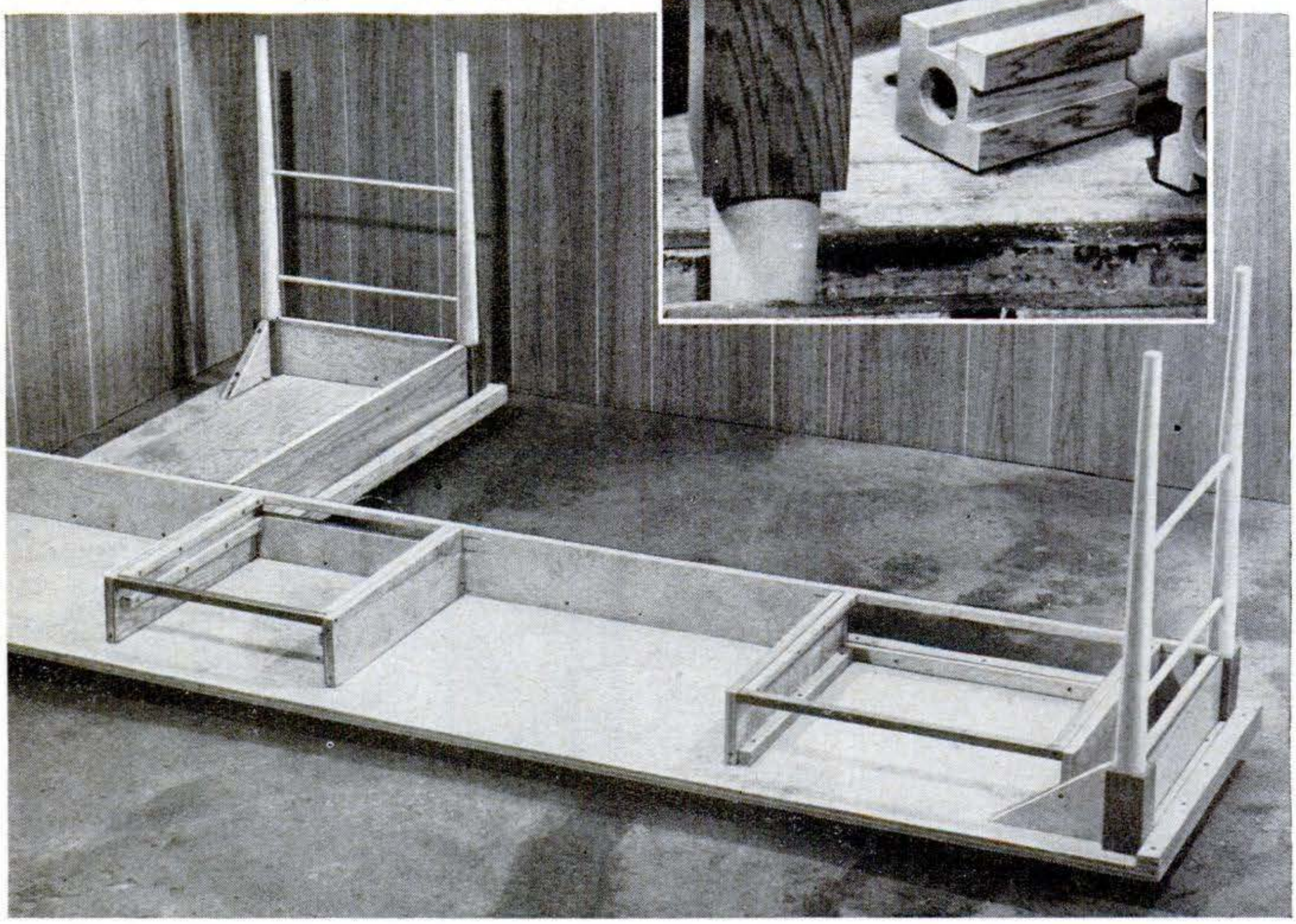
The plastic-surfaced hardboard can be fastened securely to small areas with white glue.

For a perfect fit, cement the pieces on oversize and clamp. Plane them down to exact shape later. For covering large areas, use Marlite's adhesive, Marsh C-350.

Locating the racks. Mount the rod- and gun-racks to suit the length of your gear. A felt-covered block screwed to the table top makes a padded rest for the gun butts. Shallow holes in the table hold the rod ends.

Finish off wood and hardboard edges with enamel midway in color between the light and dark tones in the plastic. Use the same enamel as a wiping stain on the racks and legs. Brush it on for a few minutes, then wipe it off.





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You double your storage by installing—

A Modern Medicine Chest

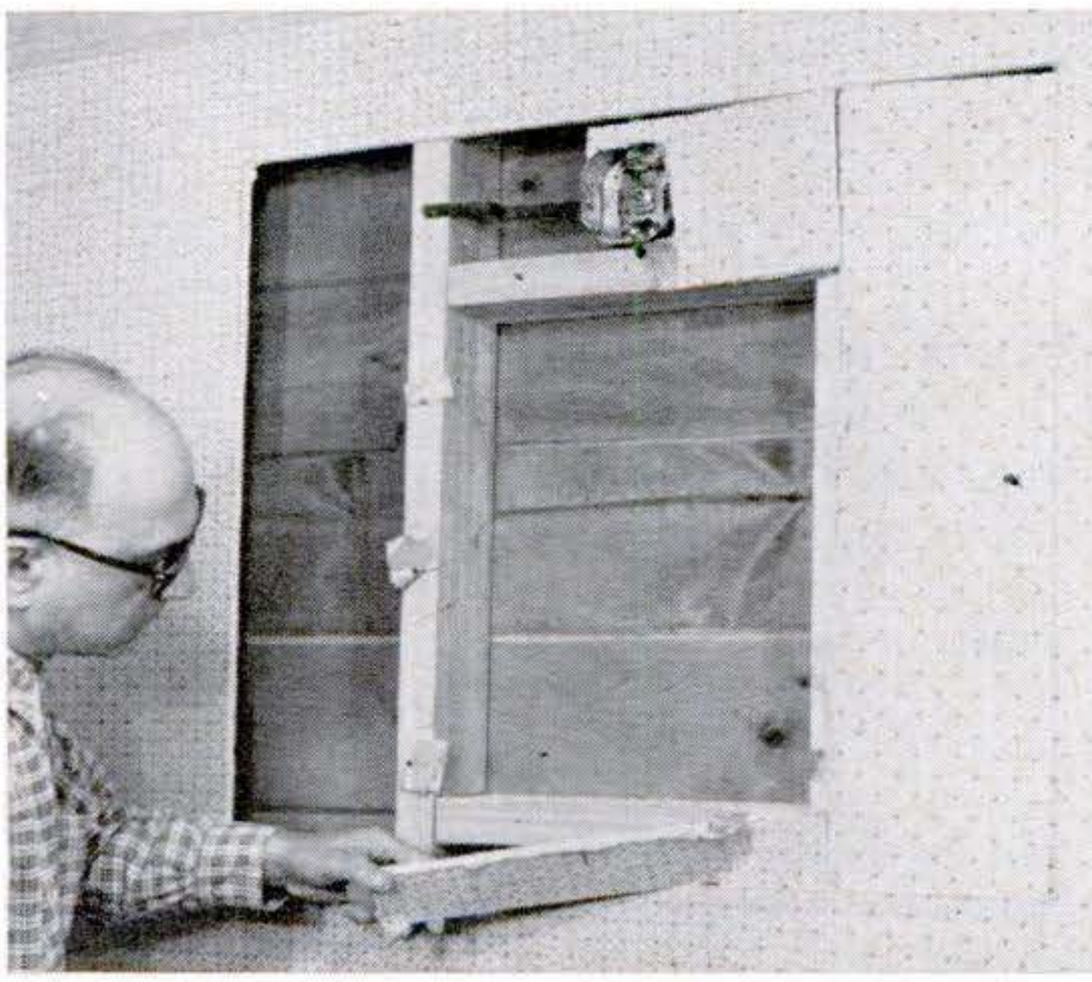
SWITCHING from a boxy old medicine chest to a modern wall unit is worth the trouble for appearance alone. But you get a practical advantage, too. It doubles your storage space.

Old-time chests are sized to fit between the studs. The new ones get away from that size restriction —and some are designed for surface installation. But you get a better job by partly recessing the new cabinet.

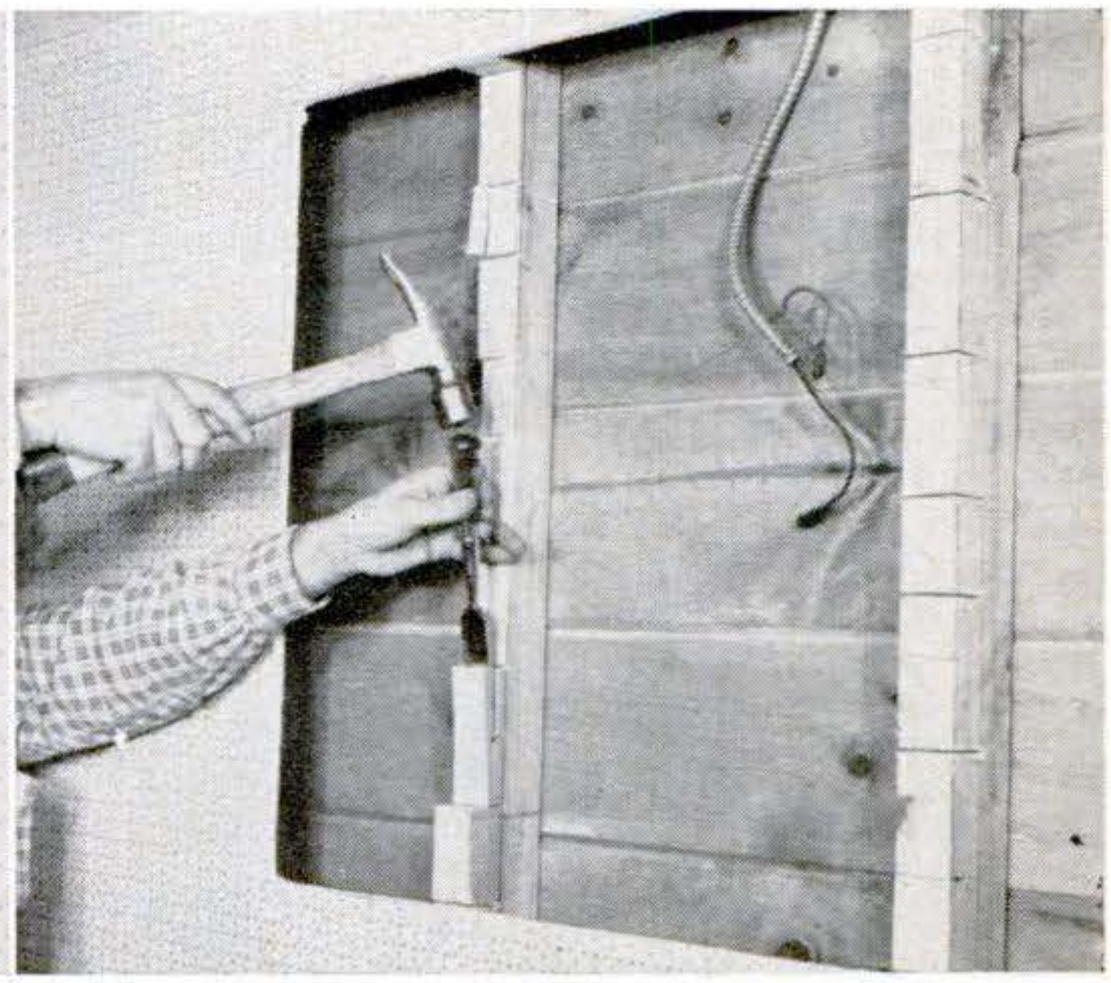
Have someone hold it level and trace its outline on the wall so you can cut a precise opening for it. In plasterboard, use a keyhole or jig saw. In plaster, chip away the surface and saw the lath.

Next you make a series of saw cuts 2″ deep in the studs and chisel away the wood between the cuts. Try the cabinet in the opening. If it binds, mark the spot and shave the plaster with a rasp until you get a snug fit. Fasten the cabinet to the studs with screws. Fill in any gaps between it and the wall with tub-calking compound.

The cabinet shown is made by the Lau Blower Co., Dayton, Ohio.



OPENINGS FOR OLD AND NEW cabinets are both seen here. The cross members can be removed.



RECESS NEW CABINET by cutting back the studs. Make saw cuts, then chisel away the wood.

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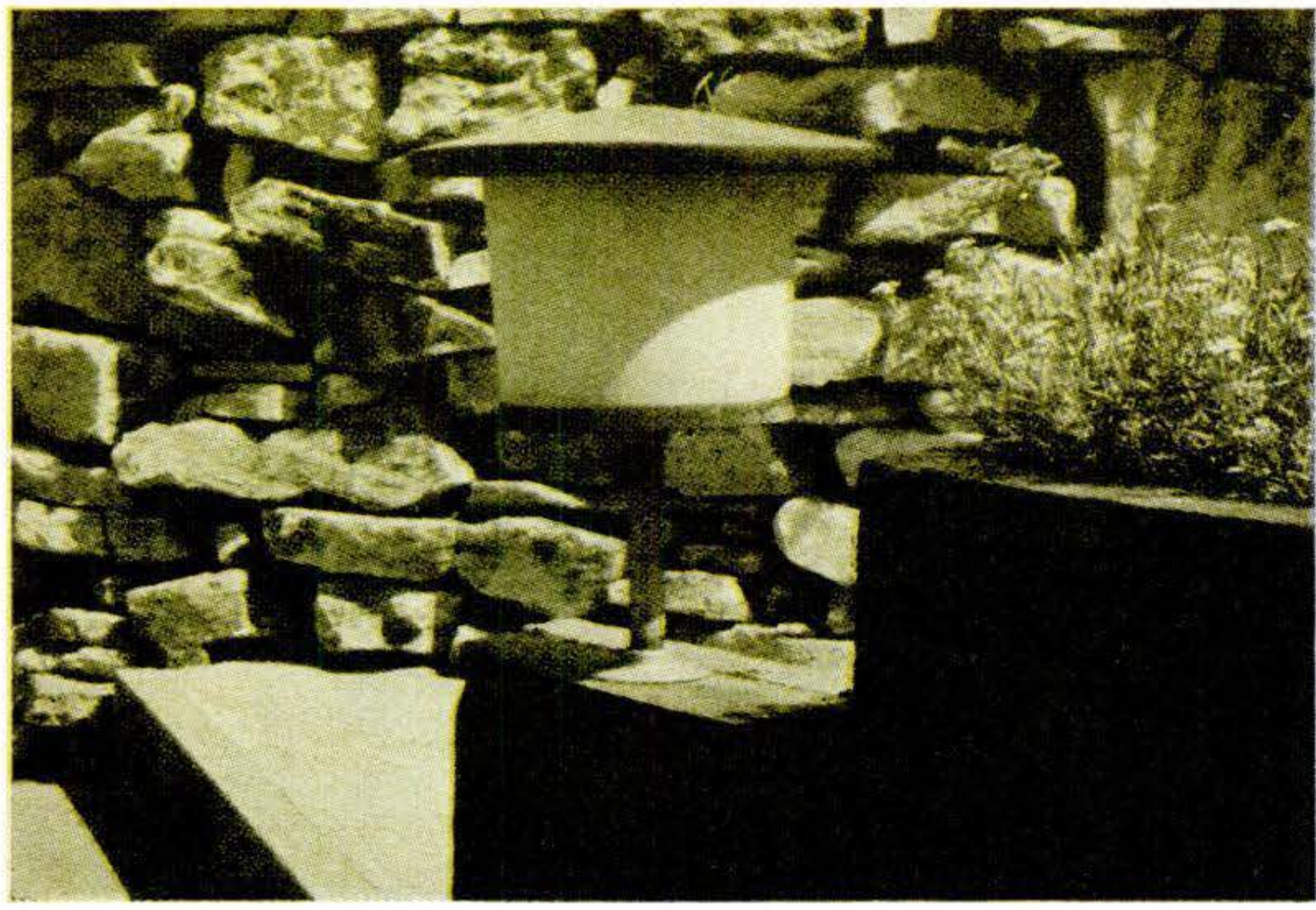
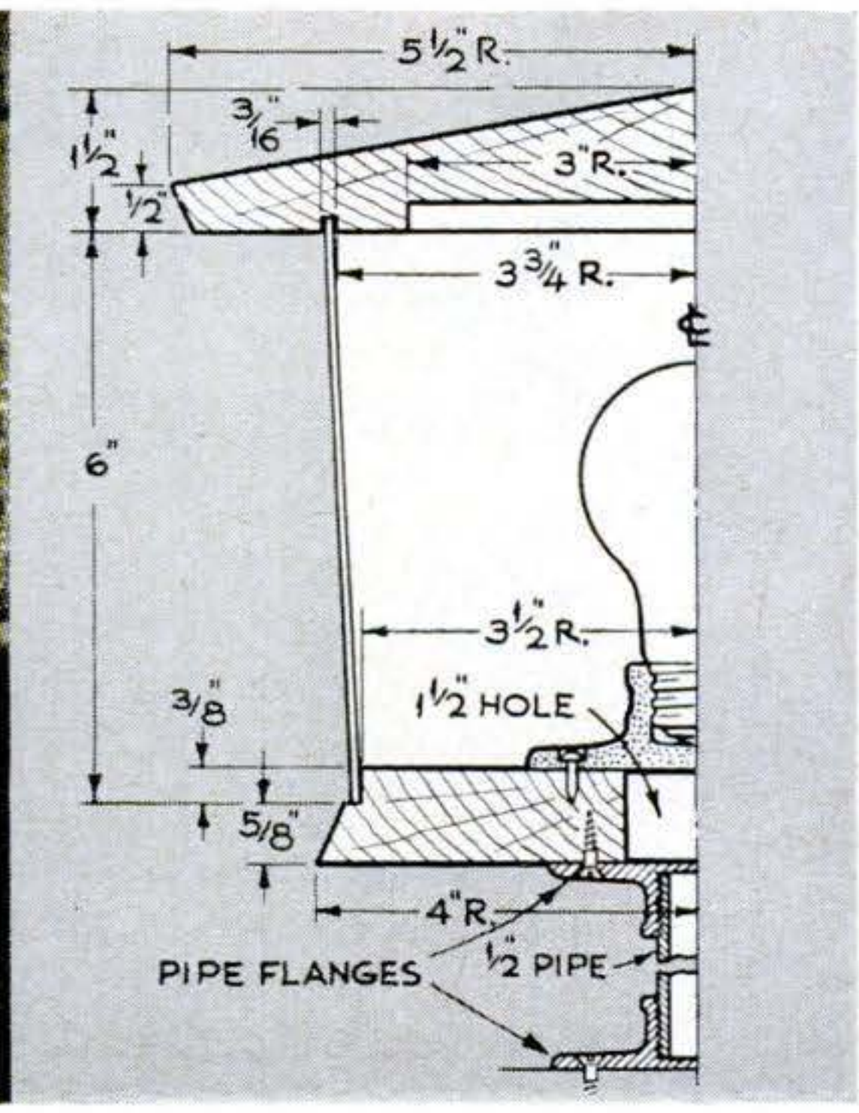
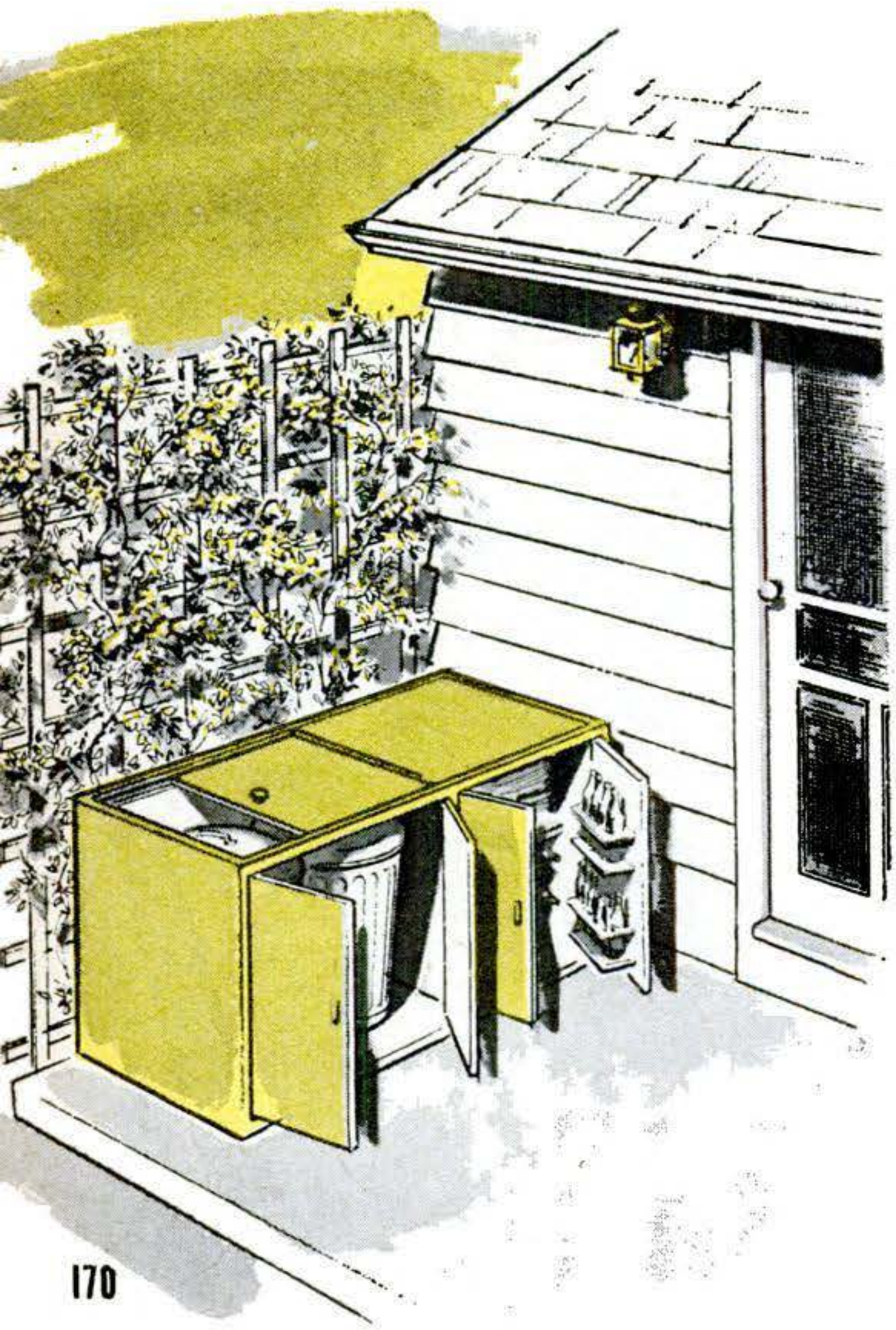
1 Garden Light from





2 Handsome Ways to



TRASH cans are a necessity, but they don't have to be an eyesore. It's easy to disguise them or make them more sightly so your service area is as attractive as the rest of your property.

Good cans are the first essential, of galvanized steel with close-fitting lids. The average home needs two 20-gallon cans. Even if you have a sink disposer, you still need closed receptacles for cans, bottles, and other refuse. Wooden boxes, cardboard cartons, or open-top drums rarely work out because empty cans and bottles still contain enough food remnants to attract vermin.

Cabinets for the cans. Trash cans ought to be close to where they're needed, usually just outside the kitchen door. They can be housed there in a closed cabinet. Louvers will provide ventilation.

[*Continued on page 176*]

ON A BACK PORCH: This cabinet combines space for refuse cans, empty bottles, and old newspapers. Cans are filled through a sliding door at the top and emptied through hinged doors at the front. Tempered hardboard is a good material for outdoor enclosures.

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a Wastebasket

YOU can make colorful outdoor lights from polyethylene-plastic wastebaskets—the kind you can pick up at most hardware, variety, and department stores for less than $1. The baskets are about 8″ in diameter and come in many pastel shades. Yellow is fine for a garden.

The lamp is supported on a pedestal of ½″ pipe, which can be made any length for mounting on a wall or in the ground. Circular cap and base pieces can be lathe-turned from two-by-twelve lumber or they can be built up from circular layers of flat stock. The bottom of the basket is cut out with a sharp knife to slip over the shoulder on the base. The upper rim is also trimmed off so it will slip into a groove in the cap.

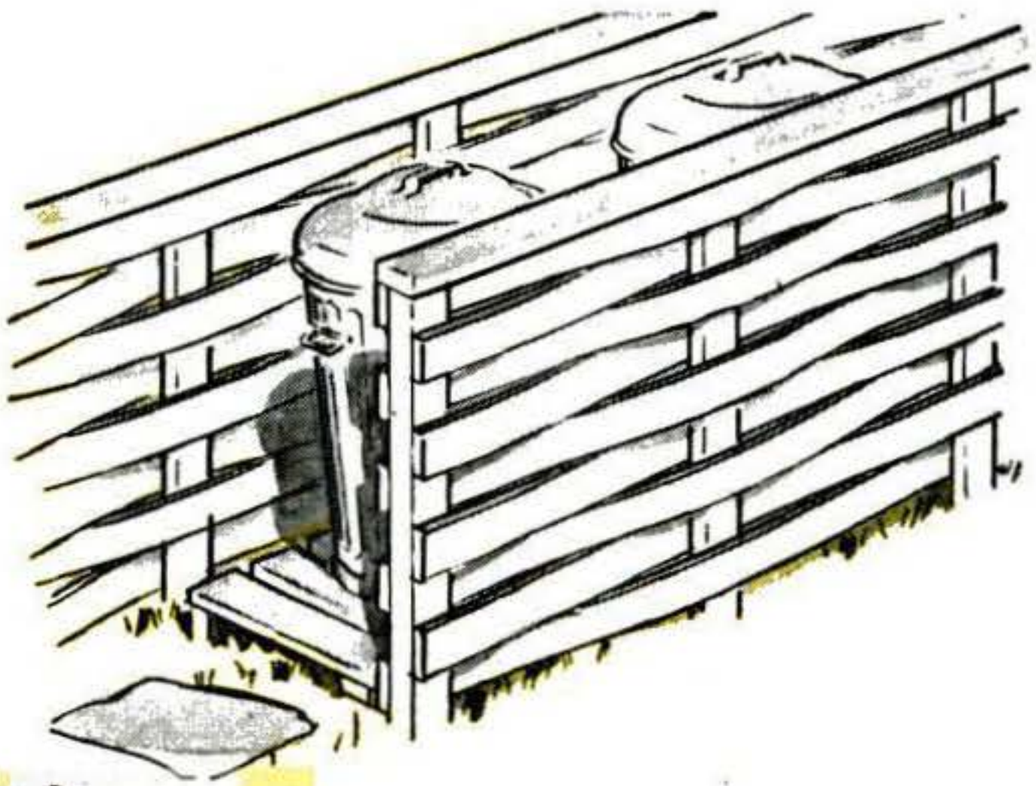
Wires lead down the pipe pedestal. Plastic-covered cable, called "underground feeder," is now acceptable in most communities and can be run below ground, even embedded in concrete. Get the three-wire, grounded kind.

3

FRESH IDEAS FOR

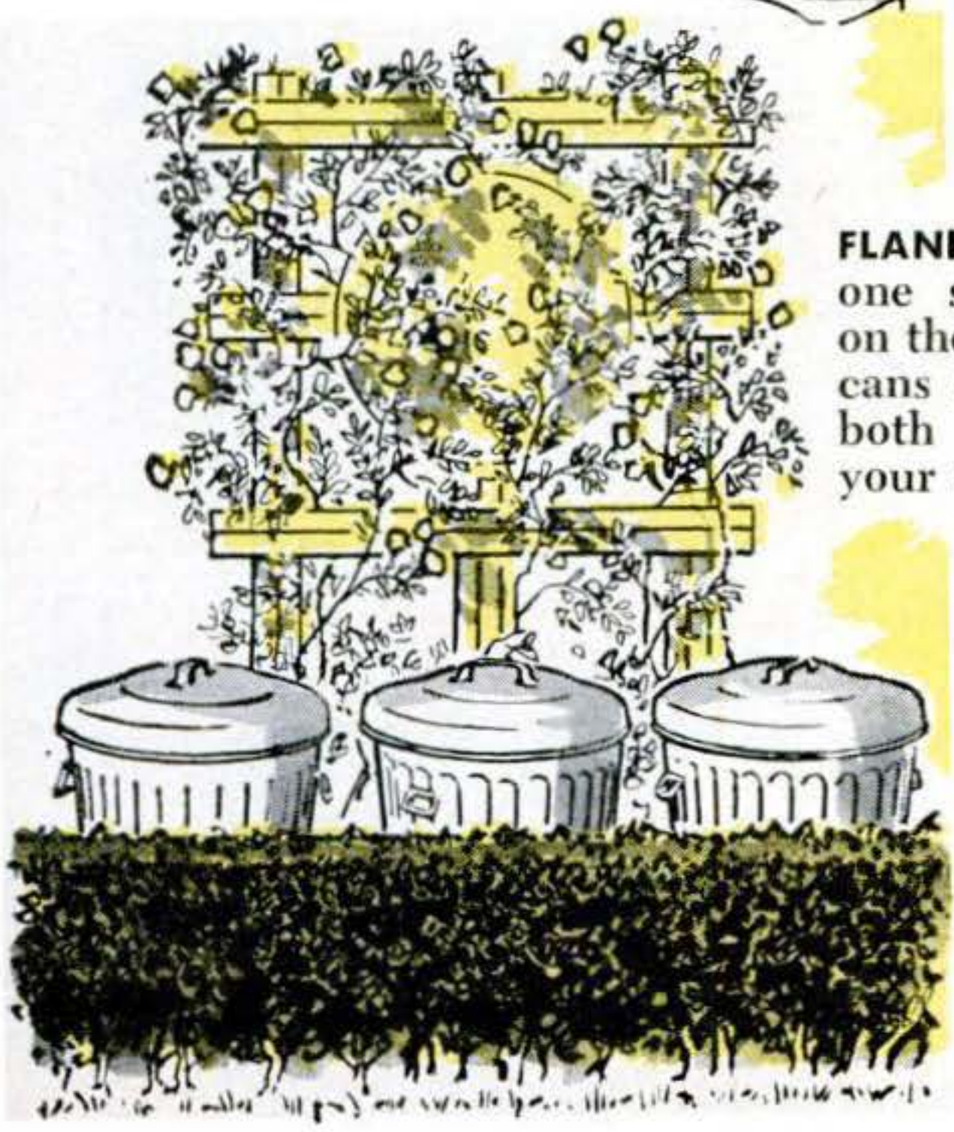
Better Outdoor Living

Hide Trash Cans



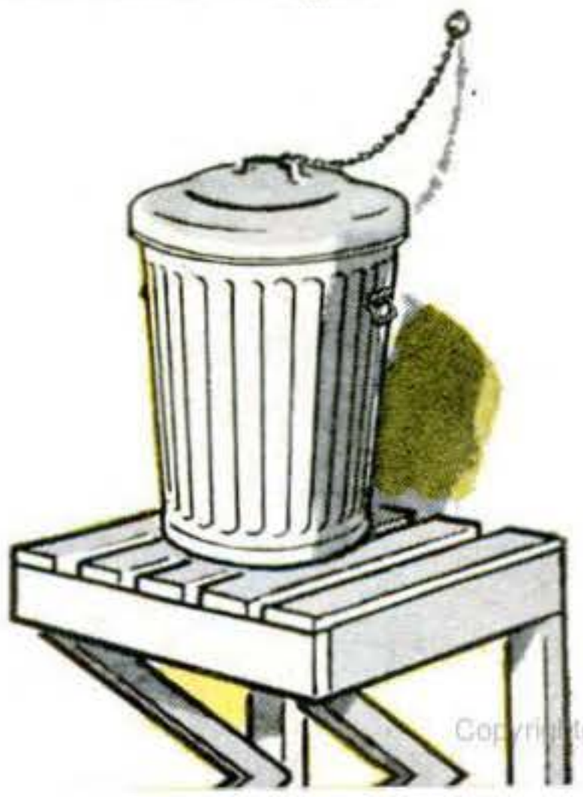
BEHIND A FENCE: Matching the design of the main fence, a short section effectively camouflages cans, yet makes them easy to get at.

SWINGING ON A GATE, this trash can is reached easily from the house side, is kept out of sight on the collection side. Brace the shelf and use heavy hinges to support the can's weight.



FLANKED BY A HEDGE on one side and a trellis on the other, these trash cans are screened from both your view and your neighbor's.

WALL BRACKET holds a trash can off the ground so it can't rust out at the bottom or be tipped over and spilled by prowling animals.



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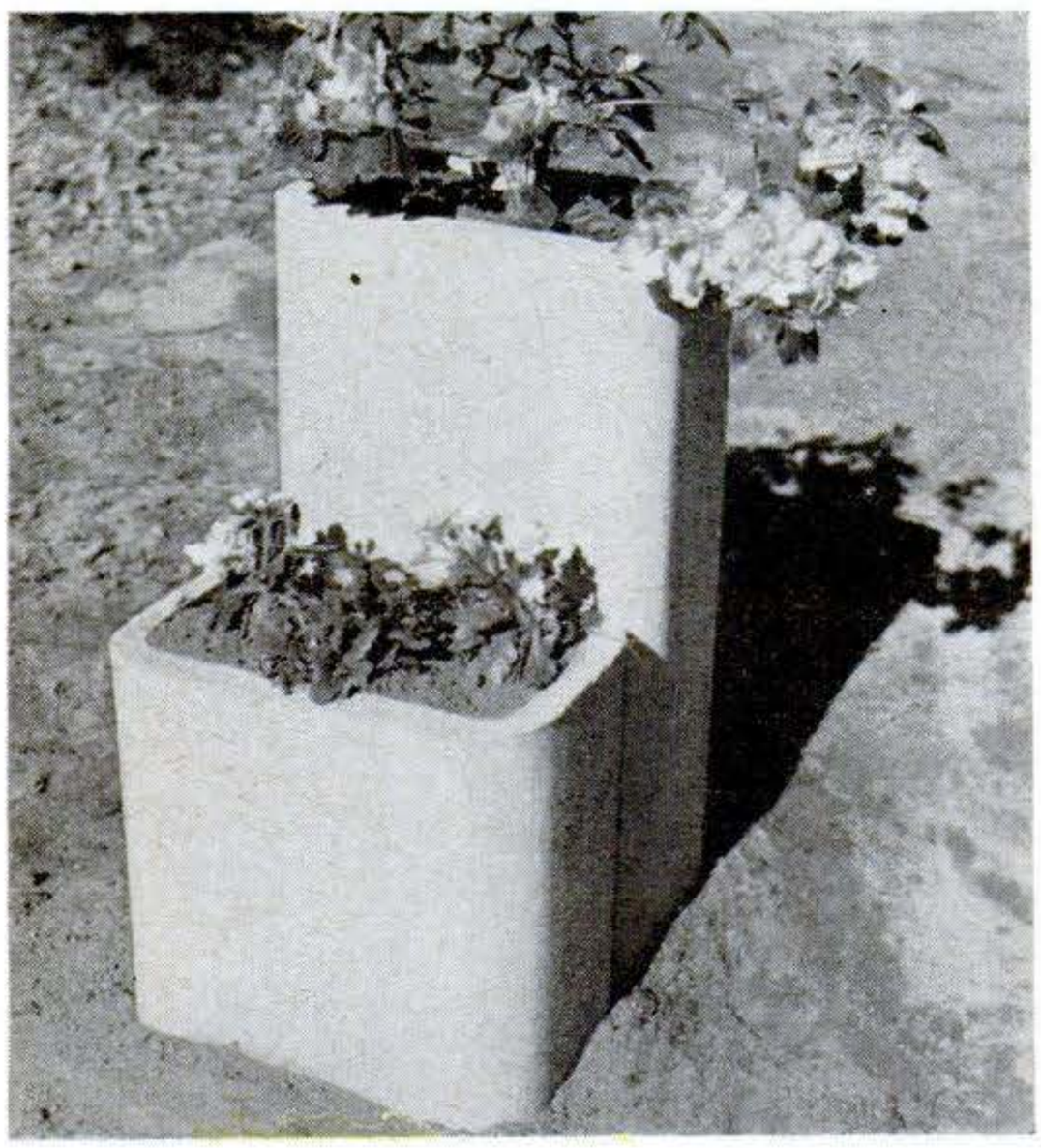
What You Can Make ... 3

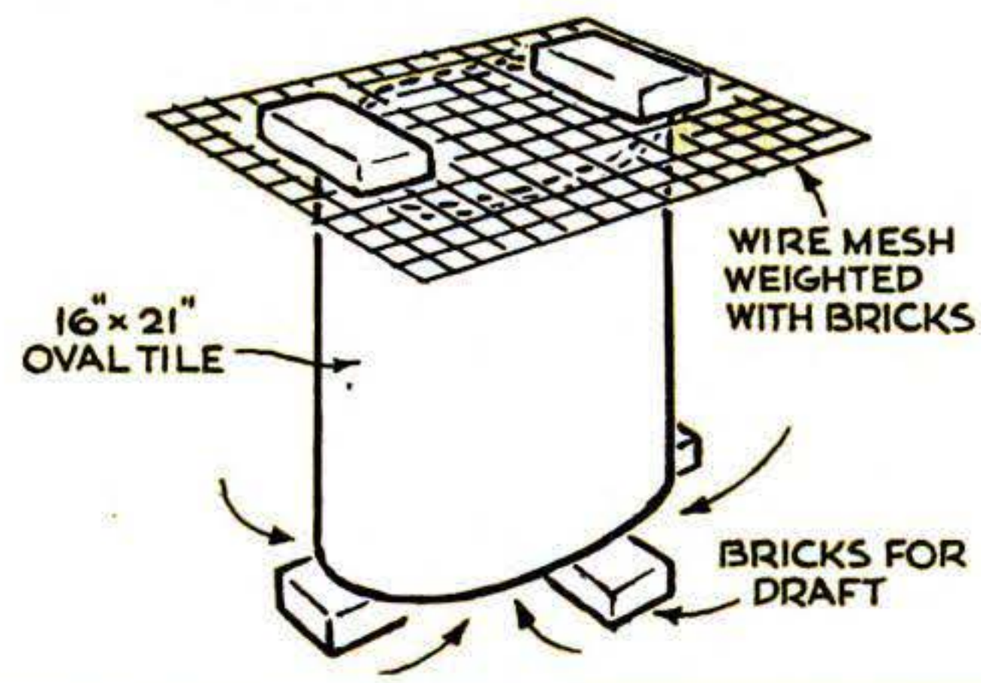
YOU can build a lot more things with chimney-flue tiles than chimneys. These square, oval, and round clay building blocks are ideal for any number of outdoor improvement projects.

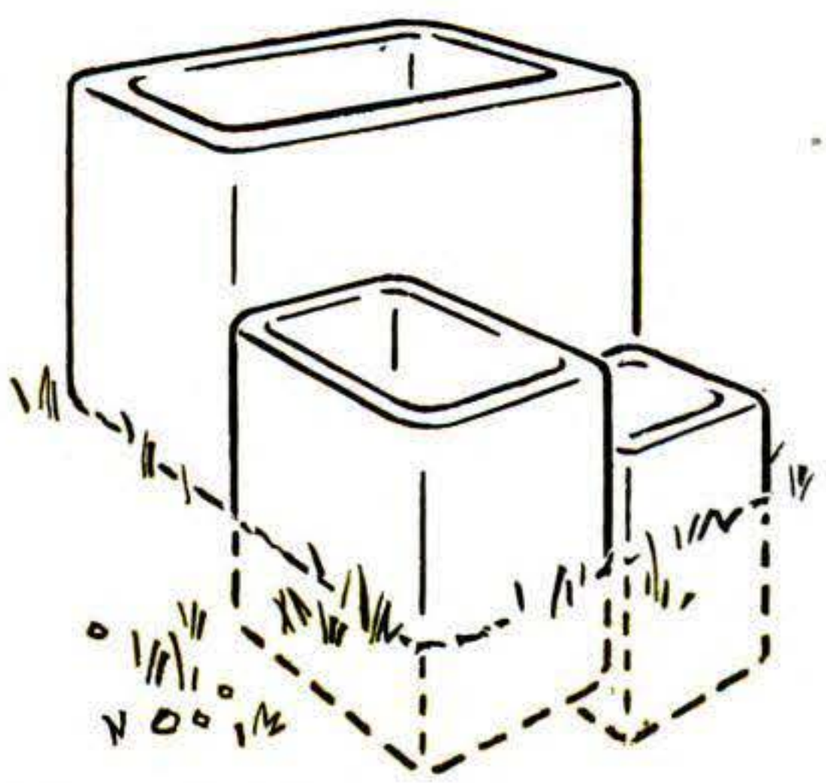
You can use them to make patio furniture, barbecues, plant containers, incinerators, bird baths, and to support posts for outdoor lights, carports, and other structures. The tiles are handsome, fairly inexpensive, weatherproof, and practically indestructible. Colors are natural tan and pink. The standard length is 2′, but many widths are available.

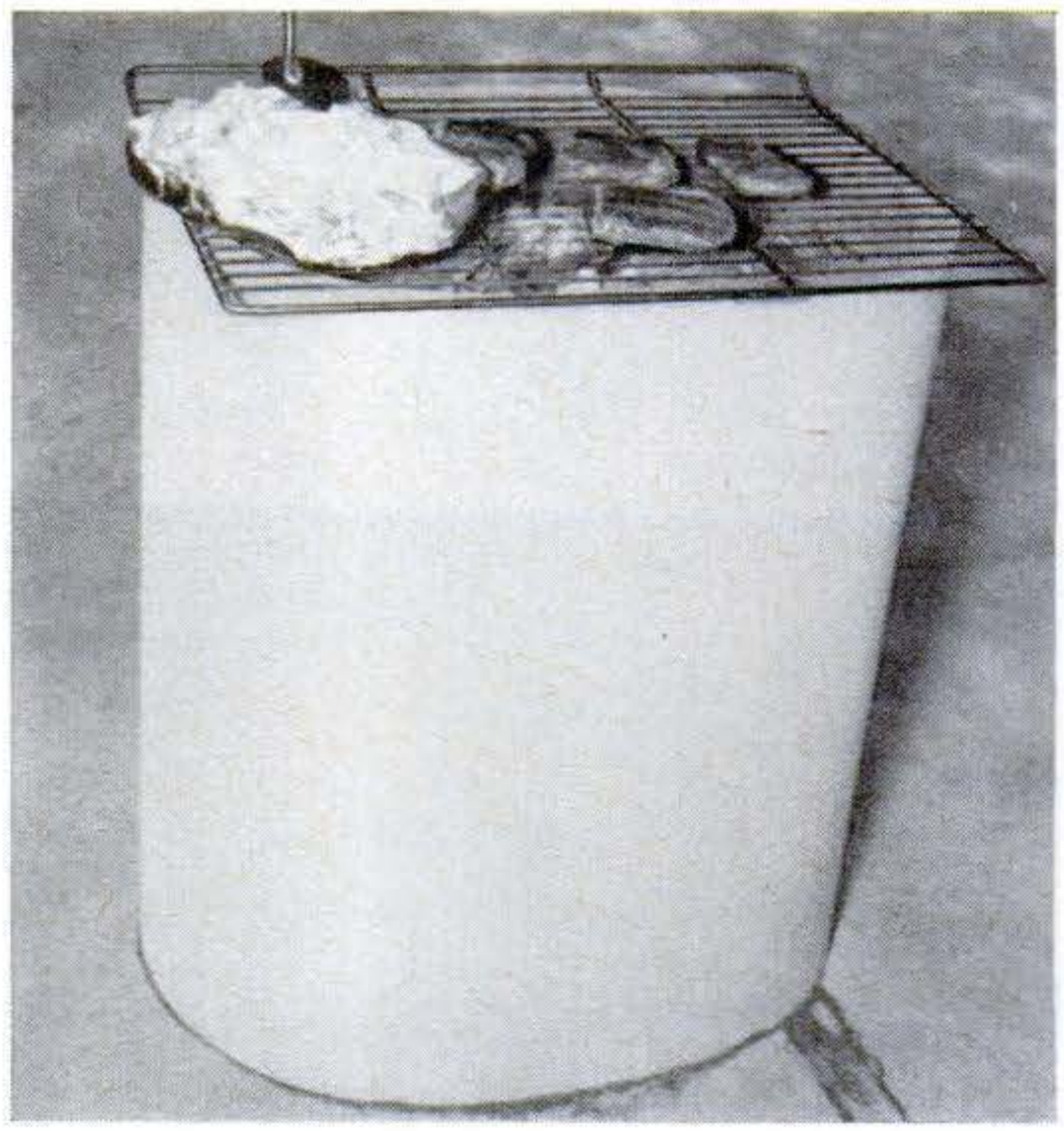
Prices vary in different localities, but you can figure roughly that the smaller tiles 6″, 8″, and 10″ wide cost $2 to $4 apiece. Prices go up sharply as you get into larger sizes, with some 20- and 24-inchers selling for $10 to $14. It's a good



BACK-YARD BARBECUE made from a 16″-by-21″ oval tile (photo below) can be left out all year, can't rust. Fill it with stones to within 8″ of the top and add a layer of sand or gravel for a charcoal bed. A similar tile makes a fireproof incinerator for burning trash. Block it up on bricks for a draft and cover it with wire mesh.







DECORATIVE PLANTERS can be given many modern arrangements with different shapes and sizes of tiles, will never rot out as wood boxes do. Vary the heights by sinking tiles part way into the ground—it's a lot easier than attempting to cut them the length that you want.

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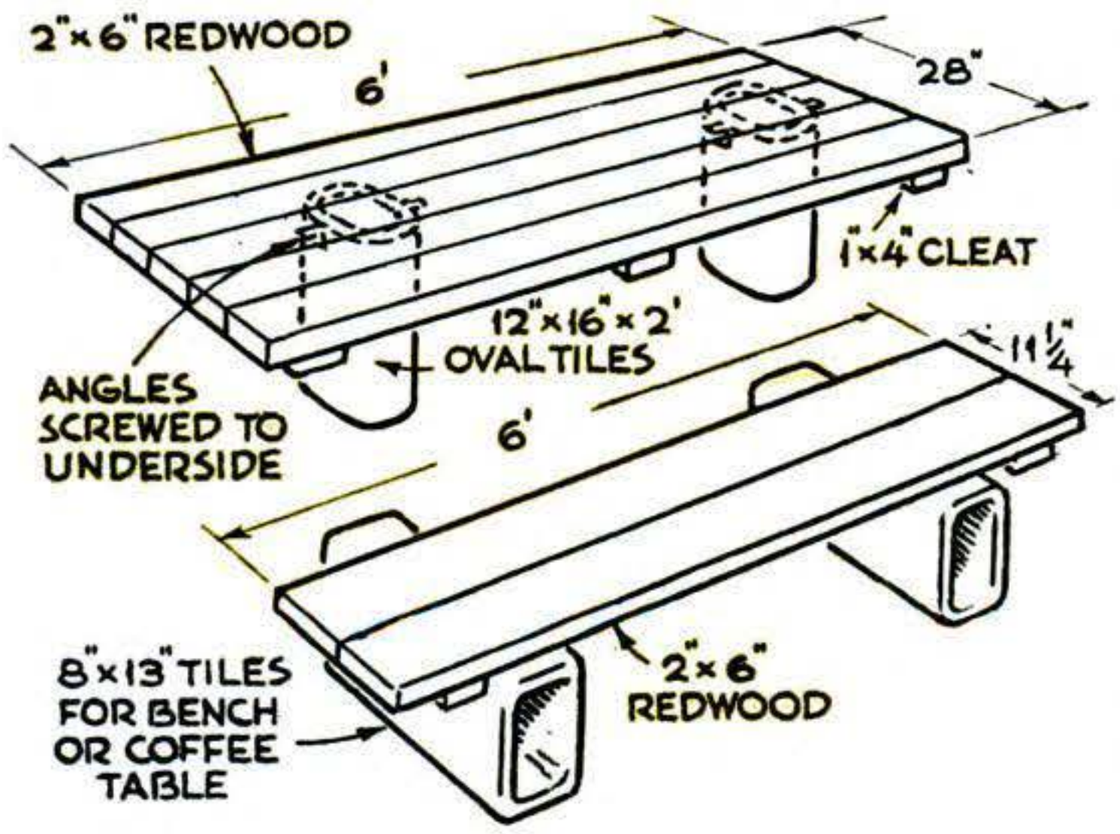
idea to see just what your local lumberyard has on hand before you start; not all types are available at all yards.

Your own sense of proportion is the best guide in choosing the right sizes of tiles. To avoid looking spindly, for instance, supports for a table shouldn't be more than several inches narrower on each side than the table top. Benches should be at least 10″ high for the low

PICNIC TABLE is easy to make with a redwood top set on two oval tiles stood upright. Table can be left outdoors all year without deteriorating, or can be dismantled quickly. Top, made of five two-by-six planks, is heavy enough to stay put without fastening. For a permanent job, it can be bolted to the tiles with angle brackets. A table like this costs about $15.



OR IT CAN BE A COFFEE TABLE when the top is placed on these low 8½″-by-13″ rectangular tiles. Use it outdoors in summer, move it indoors in winter to make a playroom cocktail table.

BENCHES FOR TABLES, or for use around the garden, are made with the same 8½″-by-13″ tiles used for the coffee table. Seat consists of two 2″-thick redwood planks cleated together.

CONTINUED

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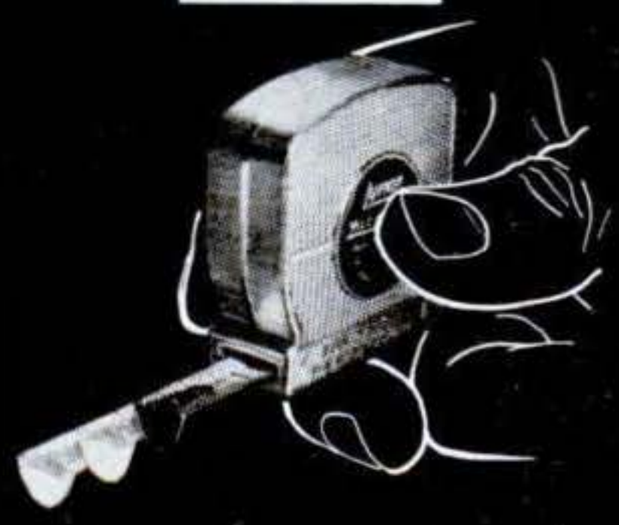
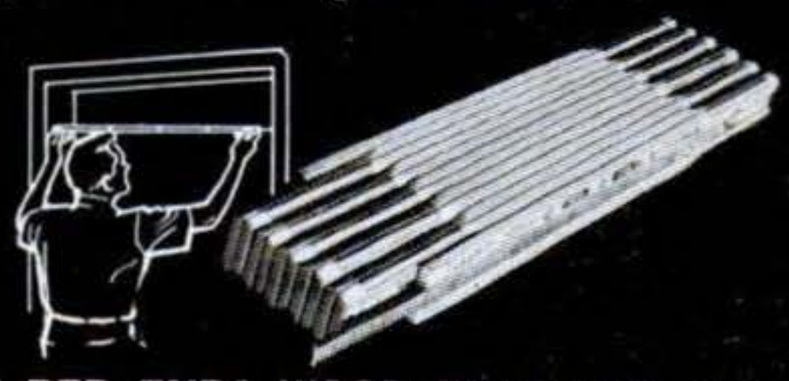
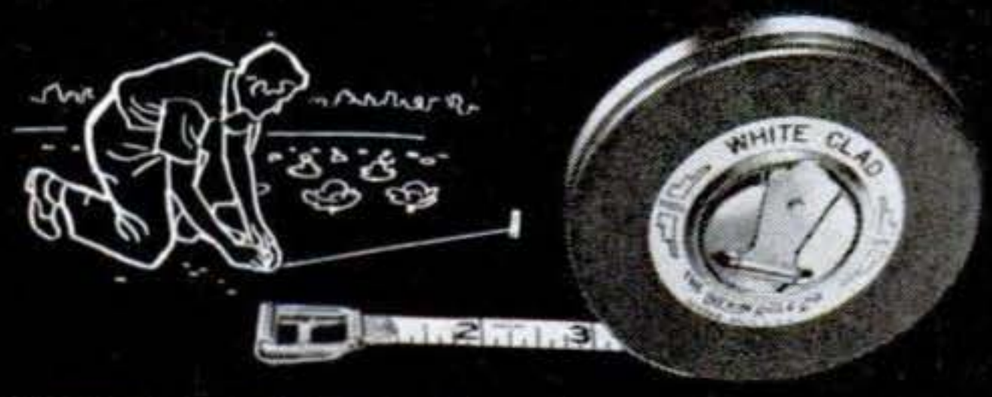
Why every home needs all 3 . . .



LUFKIN MEZURMATIC® TAPE RULE. Zip it out smoothly and measure curves, around corners, or straight up! Automatic; touch-control blade. Press to retract, release to stop. Easy to read markings on exclusive *White Clad®* steel blade. 6, 8, 10, and 12-ft. lengths. 12-ft., $2.29.



LUFKIN RED END® WOOD RULE X46. Hang a picture, hang a door, or measure *inside* a cabinet drawer. Carpenters' favorite! 6″ brass extension for hard-to-get-at measuring. Sturdy hardwood, rustproof, *riveted* joints. Bold, black markings *imbedded in wood*, plastic coated. 6-ft., $2.50.

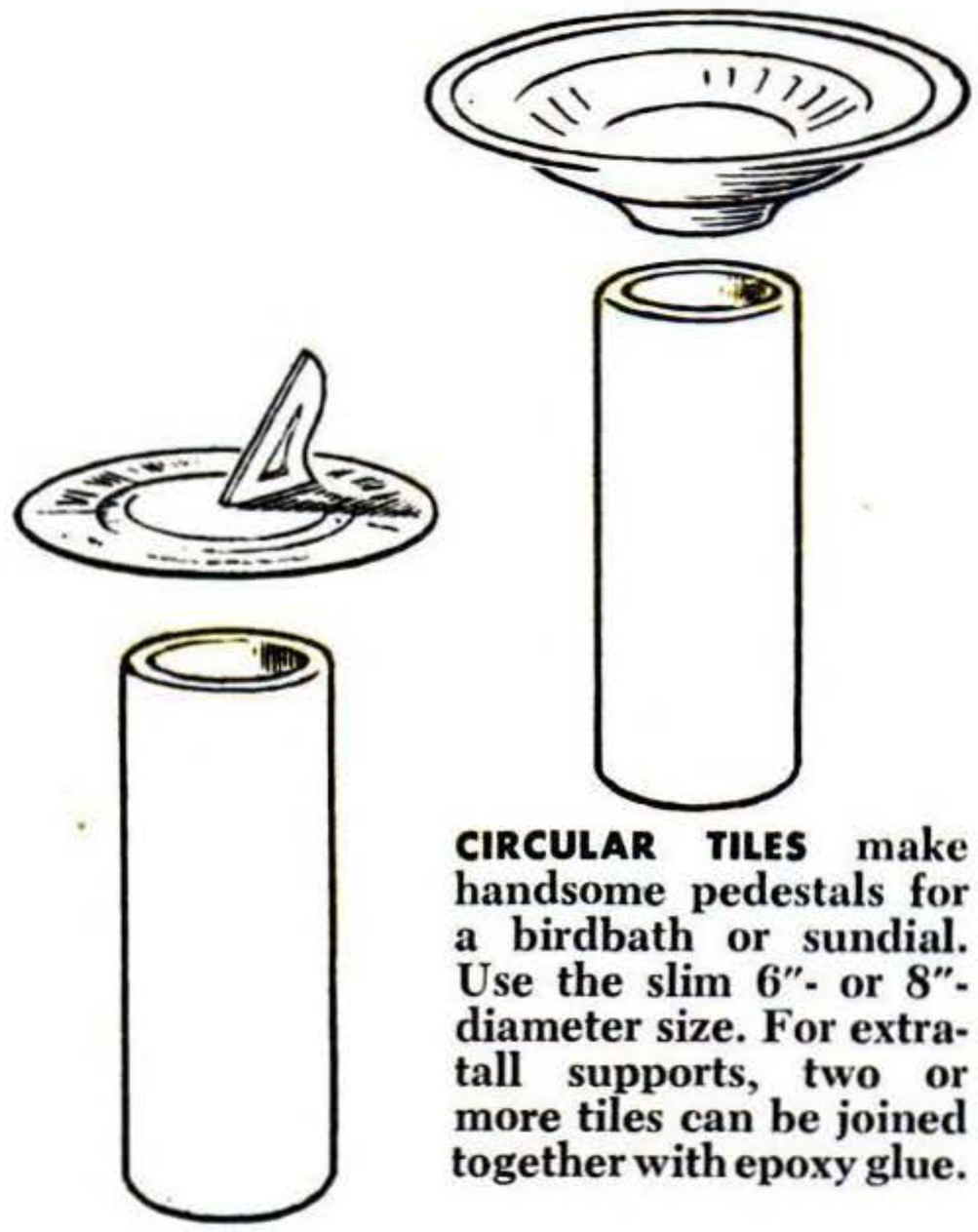


LUFKIN BANNER® 50′ TAPE. Perfect for fast, accurate *long-distance* measuring, in home, garage or yard. Hook folding end here, read line there — without help! Bold, black markings on exclusive *White Clad®* steel line. Glides easily on double rollers. Vinyl-covered steel case. 50- and 100-ft. lengths. 50-ft., $5.49.

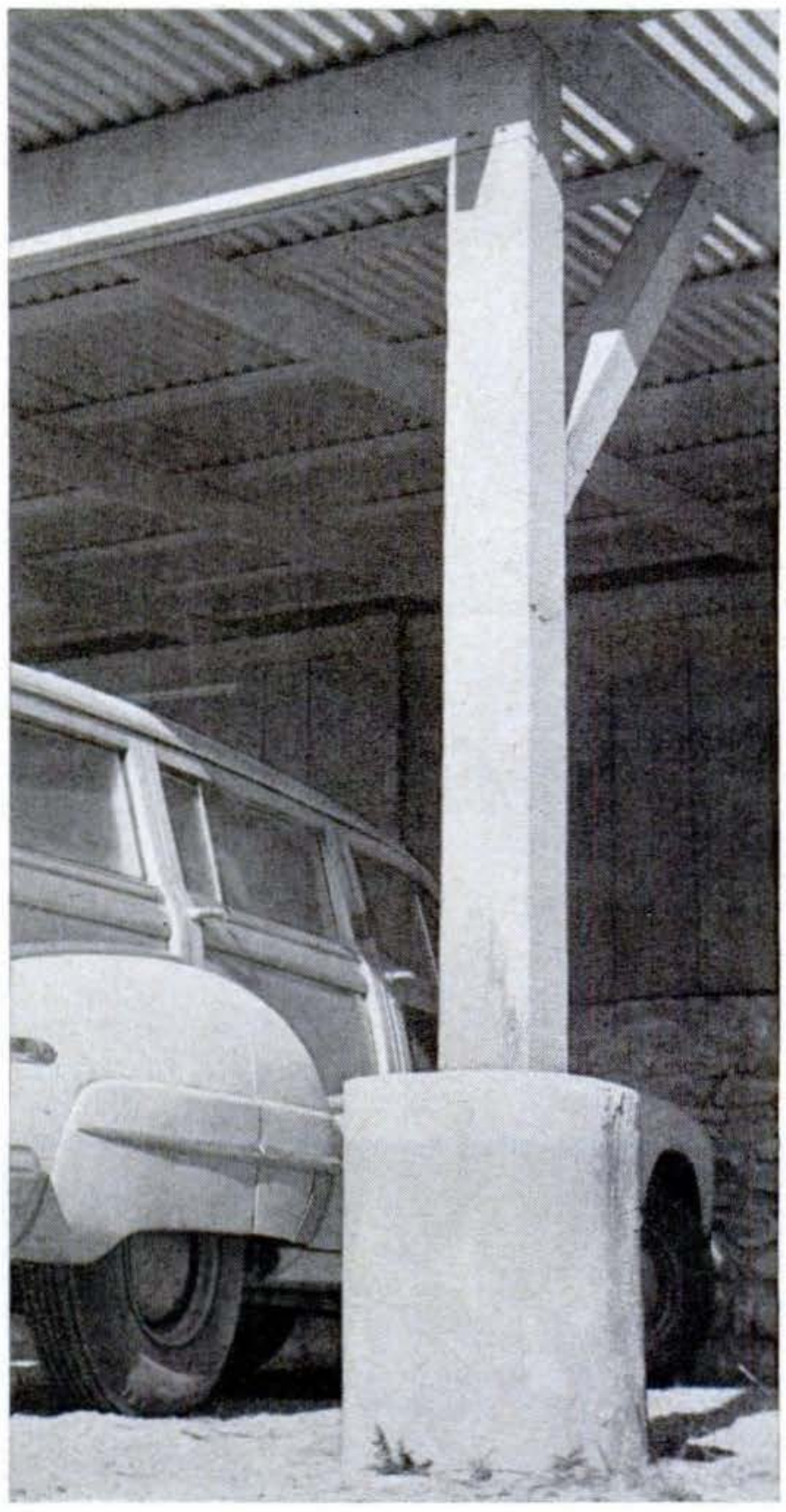
Leading hardware and building supply stores feature Lufkin . . . measure for measure, the finest made

LUFKIN

SAGINAW, MICHIGAN



CIRCULAR TILES make handsome pedestals for a birdbath or sundial. Use the slim 6″- or 8″-diameter size. For extra-tall supports, two or more tiles can be joined together with epoxy glue.



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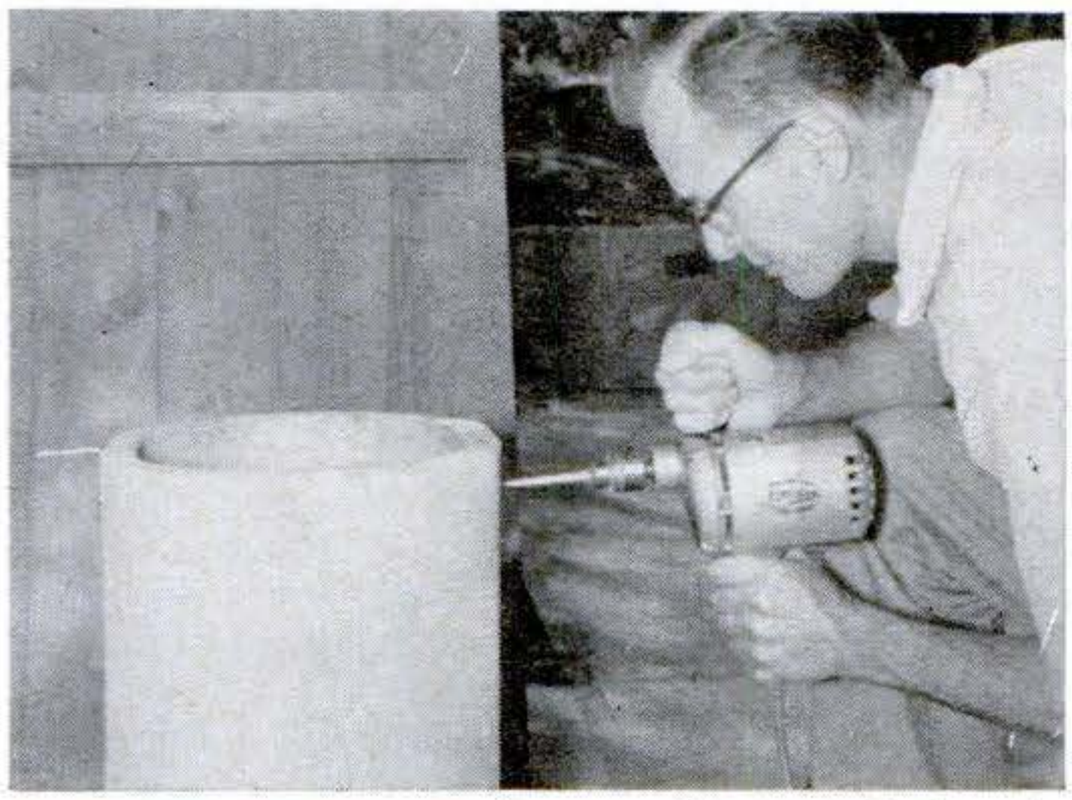
garden type, 16″ to 18″ if you're going to sit on them to eat.

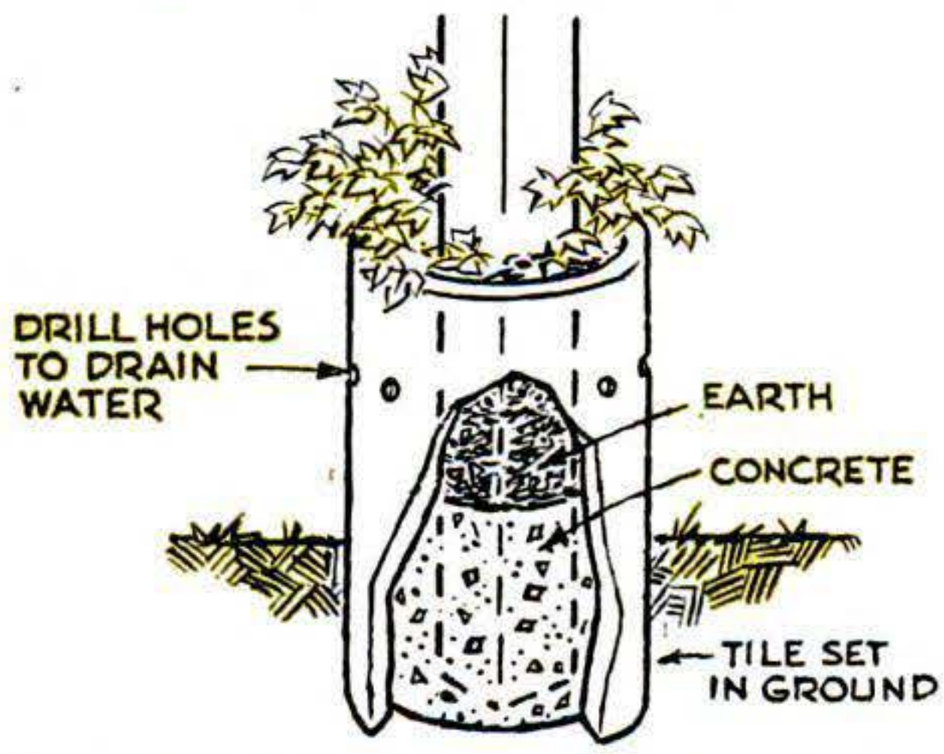
Circular tiles come in diameters from 6″ all the way up to 36″ in 2″ steps. Typical sizes for rectangular, square, and oval tiles are:

Rectangular	*Square*	*Oval*
4½″ by 8½″	8½″	8½″ by 12¾″
4½″ by 13″	13″	8½″ by 16¾″
8½″ by 13″	17″	10″ by 17¾″
8½″ by 17″	20″	12″ by 16¾″
13″ by 17″	24″	16″ by 21″
13″ by 21″		
20″ by 24″		

The best material for table tops and bench seats is 2″ lumber, either sixes or eights. Redwood is a good bet for outdoor projects. In most cases, all you have to do is set the planks on the tiles and you're in business. The tiles are very heavy and solid—they stay put.



TILES CAN BE DRILLED for attaching angle brackets or other fittings. Use a ¼″ or ⅜″ masonry bit and run bolts through the wall of the tile, threading on the nuts on the inside.



TILES FILLED WITH CONCRETE make heavy piers for posts where you can't sink footings deep into the ground. If post has been rotproofed, the top of the tile can be filled with earth for a planter. Circular flue tiles at least 18″ in diameter provide excellent stability.

Are drafty windows costing you a

25% HEAT LOSS?

Why suffer another uncomfortable winter —when it's so easy and so inexpensive to use MORTITE, the "fingertip" weatherstrip. MORTITE comes in a convenient roll . . . goes on in a jiffy . . . off just as easily. Stops wind, rain, snow. Just press in place —no tacks or tools!

Bargain Box for six windows . . . $1.39. Junior Box for one window only 29¢ . . . at all hardware, department, building supply and variety stores.

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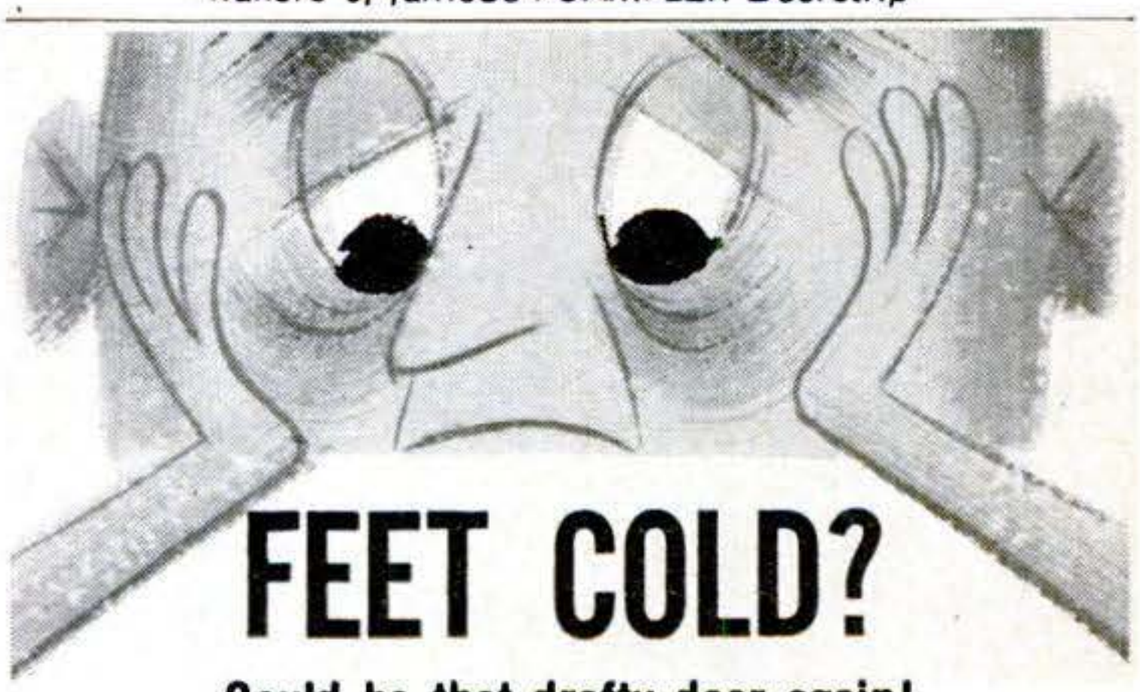
The MORTELL Company, Kankakee, Ill.
Makers of famous FOAMFLEX Doorstrip



FEET COLD?

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You don't have to go through another winter with drafty doors! You can prevent colds and sniffles, end chilling floor drafts with FOAMFLEX doorstrip . . . the perfect door weatherstrip anyone can install in minutes.

Made of genuine closed-cell, non-absorbent vinyl foam permanently bonded to Ponderosa pine moulding. Fits old as well as new doors. Package contains two 7′ and one 3′ length plus nails and instructions.

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FOAMFLEX®
DOORSTRIP

The MORTELL Company, Kankakee, Ill.
Makers of famous MORTITE window weatherstrip

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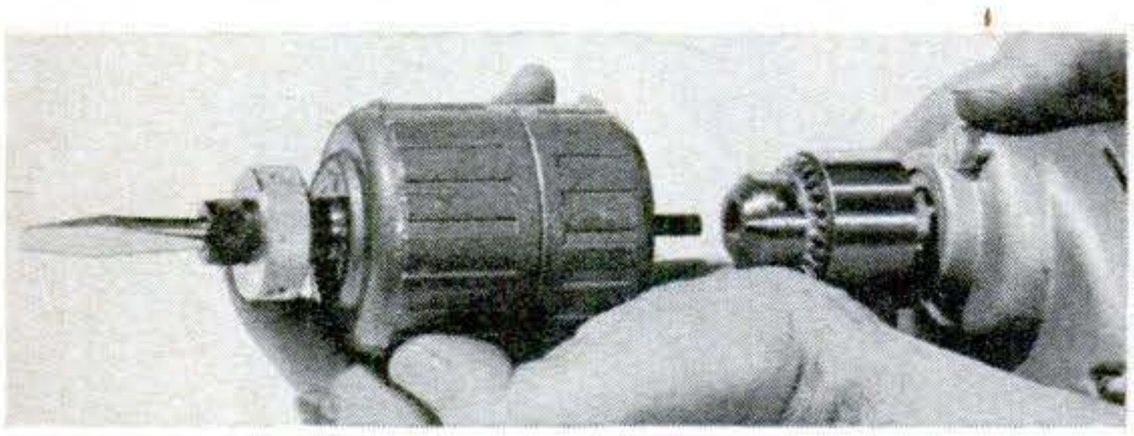
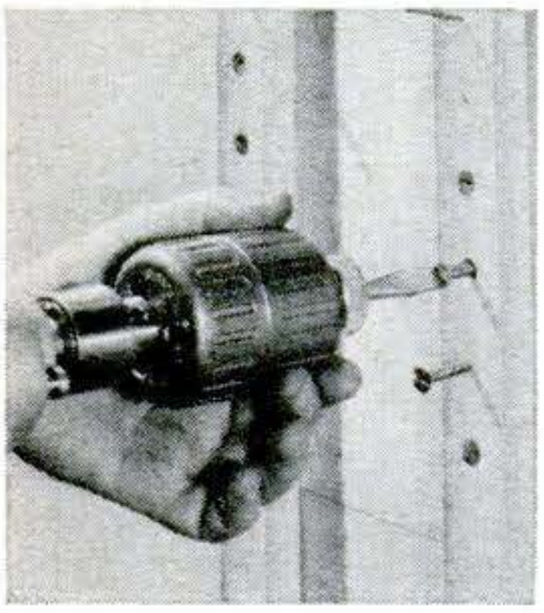
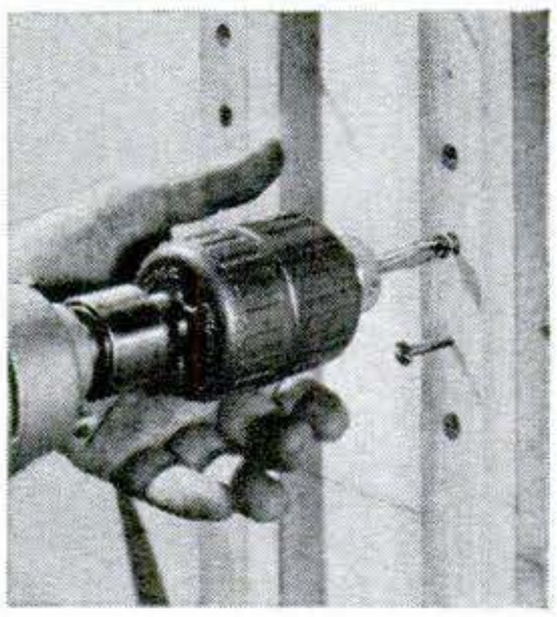
THE EASIEST WAY IN THE WORLD TO DRIVE AND **REMOVE** SCREWS



1. After drilling pilot holes simply attach a Versamatic to electric drill. Fits any make.

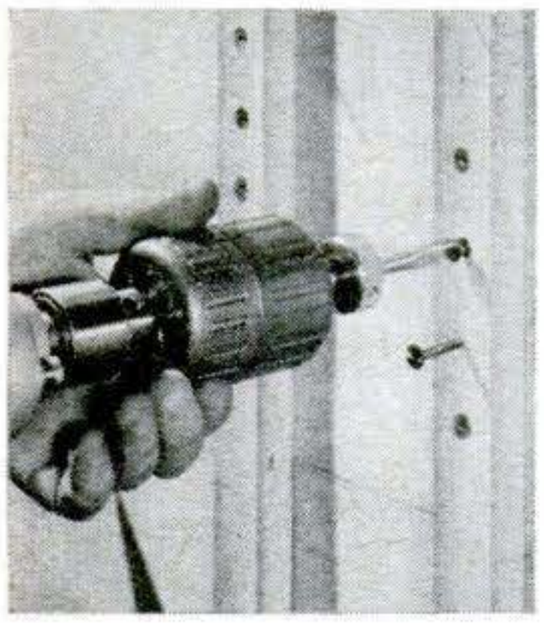


2. Place screw in hole; drive it easily with slight forward pressure . . . hold housing in fingertips.



3. Your fingers act as a clutch . . . starting, stopping action instantly. Simple and safe . . . no blisters.

Versamatic puts your power drill into **low gear**...



4. Versamatic runs in reverse for removing screws. You won't believe how easy it is until you try it.

by means of 7 to 1 speed reduction. Gives your drill 7 times more power.

Supreme Versamatic

MADE BY THE MAKERS OF SUPREME BRAND CHUCKS

SUPREME PRODUCTS CORPORATION
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Sold by leading tool dealers...$14.95 list

PRECISION A-S-R PRODUCTS

Handsome Ways to Hide Trash Cans

[*Continued from page 170*]

Use shutter-style louvered doors, or insert small, round metal louvers in a solid door. You can get types that open or close to meet seasonal requirements. Perforated steel, aluminum, or hardboard also make good, decorative ventilating materials.

Other good locations for cabinets are

A SIMPLE ENCLOSURE, open at the top, makes trash cans easy to get at, yet screens them from view. Raised bottom keeps cans off the ground; perforated sides permit ventilation.

METAL TOOL SHEDS like this are available in kits, hold three 20-gallon cans as well as all your garden equipment. Sheds are ventilated, can be painted to match the house or garage.

Copyrighted material

under an outside stairway, under a wooden deck, or along one end of a porch. Constructed of materials to match the house, a cabinet for trash cans can be made to look like part of the original house structure.

Where local ordinances require 10-gallon cans, bring them to a more convenient height by building a supporting rack. Storing cans off the ground will also

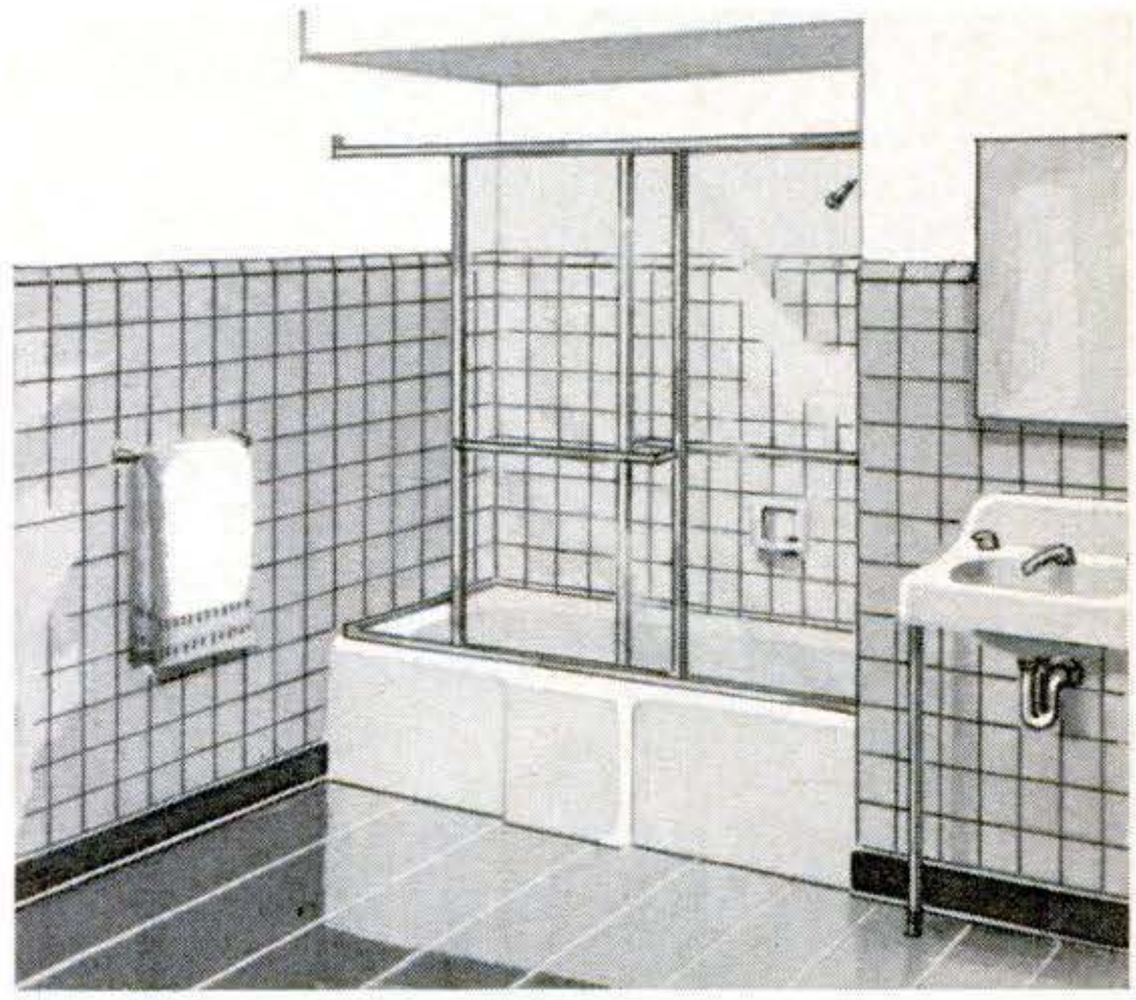
YOU'D NEVER GUESS that this flue-tile section hides a 20-gallon trash can. Can is sunk in the ground slightly to bring it below the tile's rim. Tiles come in diameters up to 36".

NO TRIP OUTDOORS to empty the garbage with this setup. The can, hidden under the kitchen counter, is filled through a trap door. Collectors reach the can through an outside door.

CONTINUED

Make Your Own Aluminum-Glass

SHOWER DOORS FOR UNDER $35



with Reynolds DO-IT-YOURSELF ALUMINUM

Make your own attractive aluminum and glass shower doors. Pay under $35 for materials. Same high quality doors that cost $70 to $80 (installed) in most retail outlets. Easy to make in hours with ordinary woodworking tools.

Write for free plans, how-to literature and check-list of over 40 fascinating Reynolds Do-It-Yourself Aluminum Projects.

Look for the Reynolds DIYA display rack at most hardware and building supply stores.

Reynolds Metals Co. • Richmond 18, Va.

Please send Reynolds Do-It-Yourself Aluminum How-To kit with FREE shower door plans.

Name _____

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City _____ Zone ____ State _____

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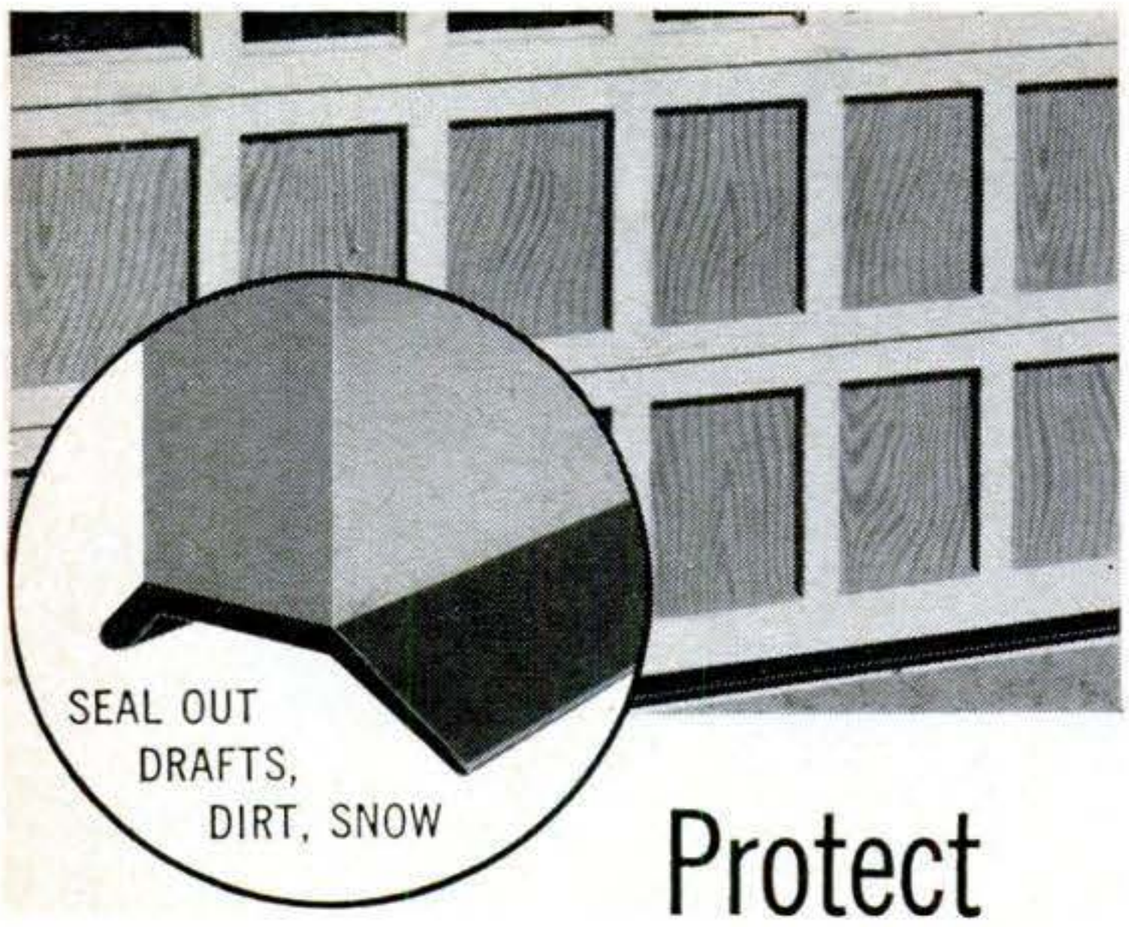

Protect costly garage doors with StanStrip*

Now . . . for less than $3.00 . . . in less than 10 minutes . . . you can put StanStrip on an 8-foot overhead garage door. And what a difference it makes!

The thick, rubber "pad" cushions the shock of closing . . . prevents damage to doors, spares the windows, ends the crash of closing.

And, just as important, the double lips of StanStrip flex to follow every irregularity in the floor . . . seal the opening completely against dust and dirt, rain and snow. Your garage stays cleaner, drier, warmer. Your car starts easier in winter.

And does it last! You just can't hurt StanStrip. The special rubber compound was developed from hundreds of formulas tested for this purpose. Stays flexible even in coldest weather. Get StanStrip now at hardware and building supply stores.

SEAL HOME DOORS AND WINDOWS, TOO
Ask for StanSeal,* the grey rubber compound strip that you uncoil and nail as you go. A tight, permanent seal in minutes. You can paint to match the frame.

For the ultimate in door-seal beauty, with no nails showing, get *deluxe* StanSeal. As easy to install and can be painted over, too.

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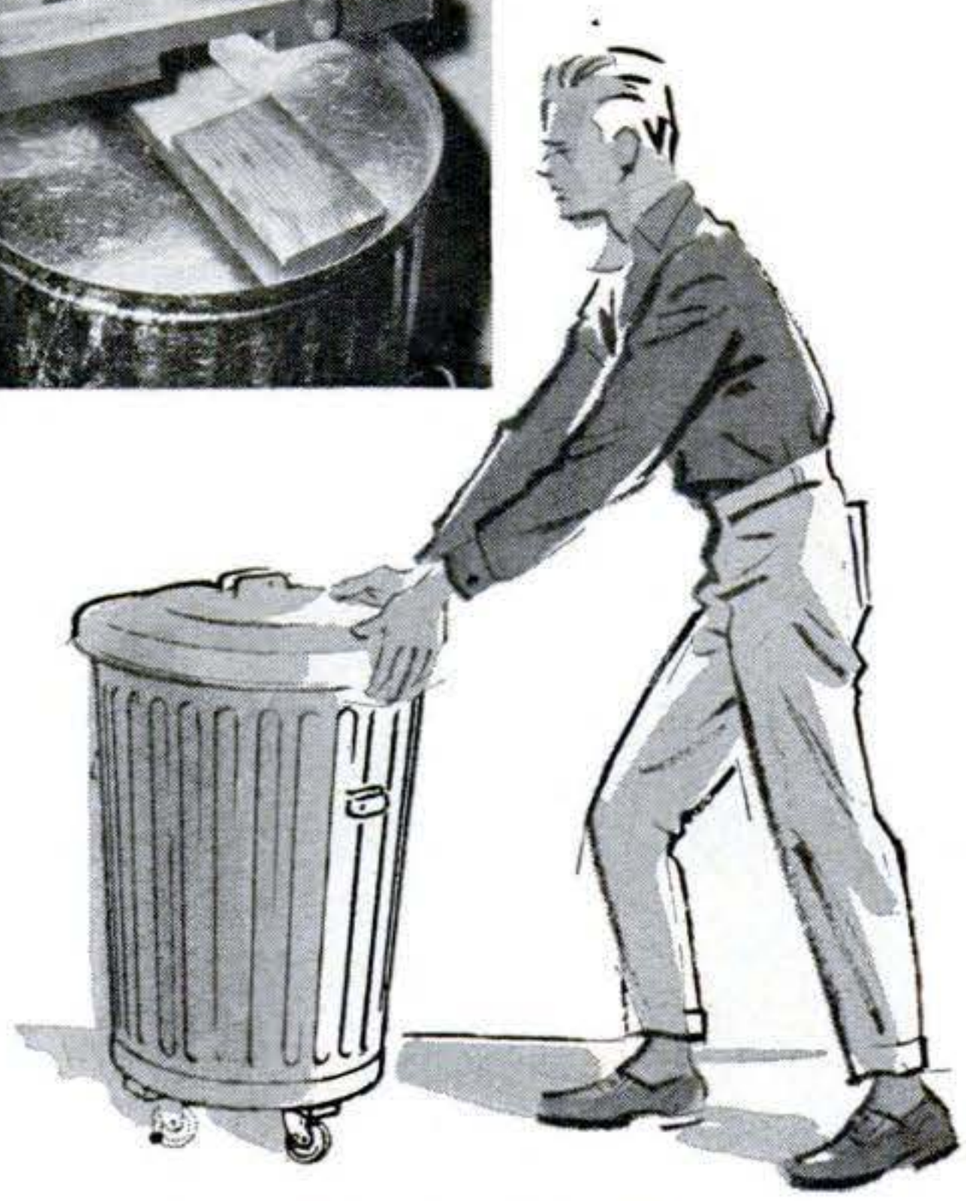
The Standard Products Co.
PORT CLINTON, OHIO



YOU CAN ROLL A TRASH CAN to the street on a dolly like this. Crisscross a pair of two-by-fours with a half-lap joint at the center and screw plate-type casters to the ends of the boards.

help prevent rusting and deterioration.

Hide a can in the kitchen. You can make a receptacle for refuse right in the kitchen itself if you can provide a place for a can in an unused corner. A trap-door opening cut in the counter will give access to the can, which may be equipped

UNDERGROUND RECEPTACLES, with lift-out pails, can't be blown over or raided by animals; are inconspicuous even when placed in recreation areas. Hinged lid is opened by a foot pedal.

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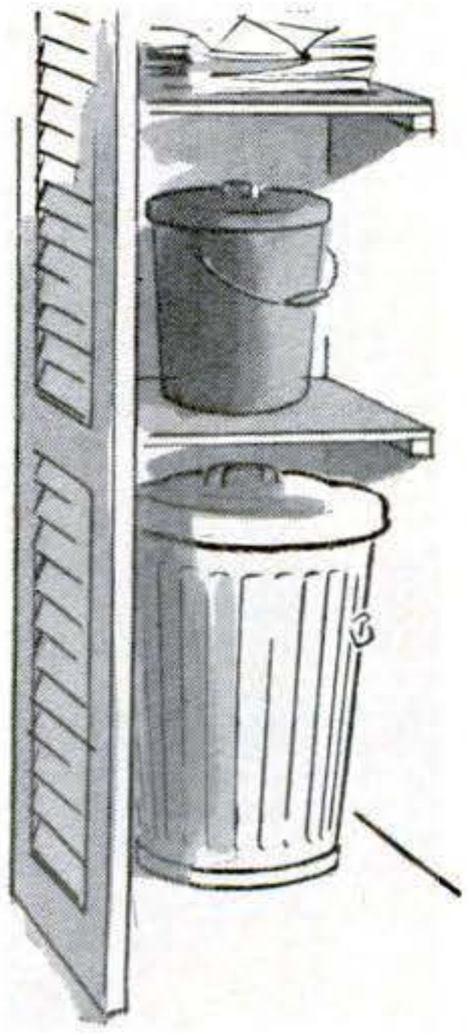
Hide Trash Cans
with a push-top, self-closing lid. Such lids are available to fit any standard can. A door placed in the outside wall will allow easy removal on pickup days.

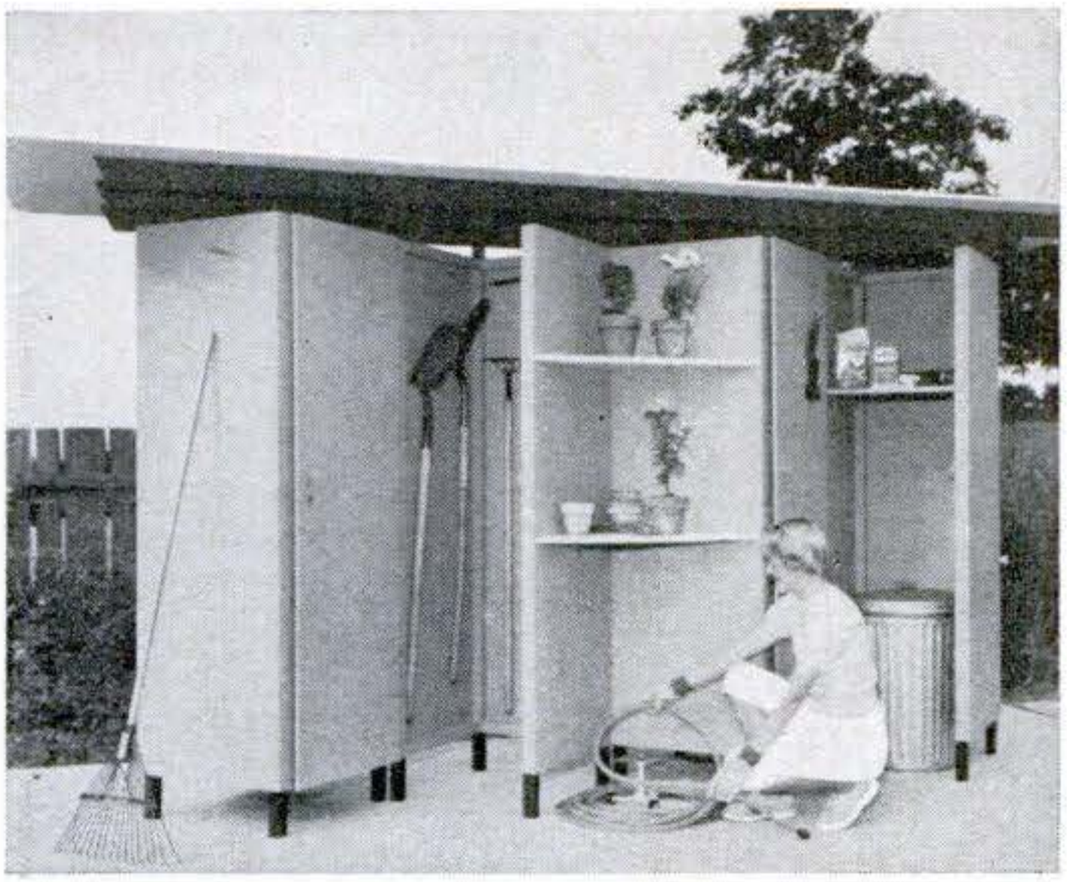
You can also hide cans in outdoor storage walls. Small cabinets can be recessed in a garage wall. Inside, the cabinet's top will form a shelf or workbench.

Cabinet wings on either side of an outdoor masonry barbecue or incinerator make good can hideaways. Often a fence can be designed with storage compartments to provide space for a scrub mop, broom, and garden tools as well as refuse cans. Sometimes just a baffle is needed to cut off cans from view. This can be a hedge, trellis, or an extension of the house or garage wall. Decorative baffles can be made of canvas, fiber-glass, perforated board, or decorative masonry blocks.



A SHELF puts a small 10-gallon can at a convenient, easy-to-reach working height. The space below it houses the larger 20-gallon size.

Special underground garbage receivers are sold that require only a hole to sink them out of sight. A step on a pedal raises the lid.



OUTDOOR STORAGE WALL hides both trash cans and garden tools. For free plans, write for Garden Storage Cabinet No. 56-60, Douglas Fir Plywood Assoc., 1119 A St., Tacoma 2, Wash.

CONTINUED

CUTS A FANCY CORNER—

HANDLES "BIG TOOL" PROJECTS

Dremel
moto-shop

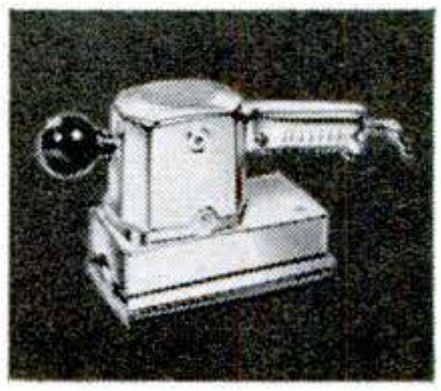
Versatile, multi-purpose tool for every workshop — and one the whole family can use. Handles delicate scroll work, or "big tool" projects. Moto-Shop is basically a 15-inch jig saw with a power take-off. It has a powerful ball-bearing motor — cuts through 1¾" wood, light metal, tile, plastics. Table tilts to 45° for angle and bevel cuts, raises and lowers to new, sharp blade area. 4-way blade holder permits cutting in any direction. Moto-Shop is self-contained — no belts or pulleys. Unique blade guard makes it safe for the whole family.

Model 571 Moto-Shop — 15-inch Jig Saw with disc sander attachment **$33.95**

Model 572 Deluxe Moto-Shop — 15-inch Jig Saw with disc sander, grinding wheel and guard, wire and cloth buffing wheels, 30" flexible shaft and a 12 piece accessory set **$49.95**

Ask your dealer for a demonstration — or
WRITE FOR POWER TOOL CATALOG

Dremel POWER SANDERS



Straight-Line action gives you a professional cabinetmaker finish. You sand *with the grain* — eliminate scratches, swirl marks — save time! Three models — from **$14.85** to **$37.50**

Quality Power Tools Since 1934

DREMEL MFG. CO., Dept. 120-J, Racine, Wis.

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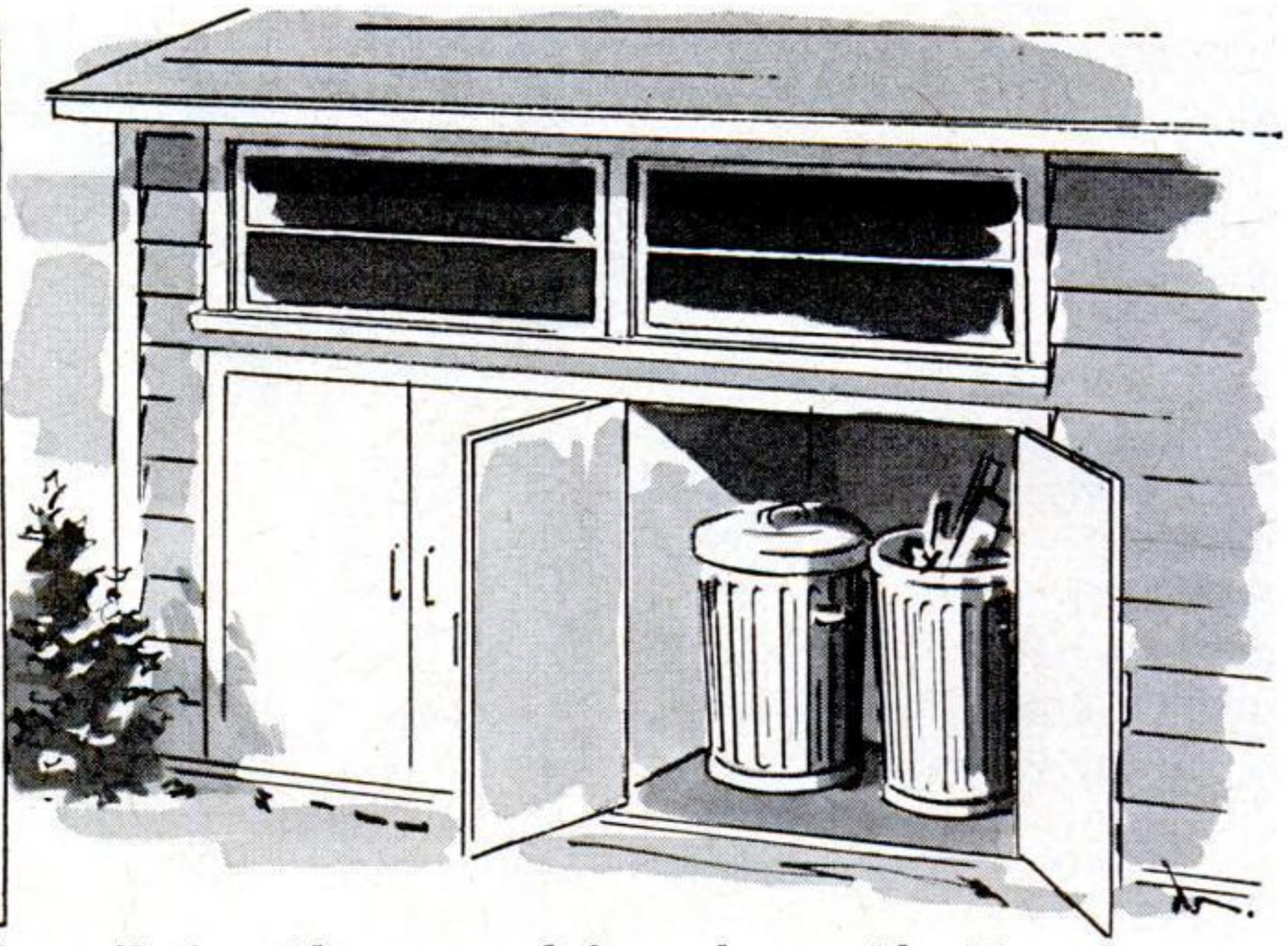
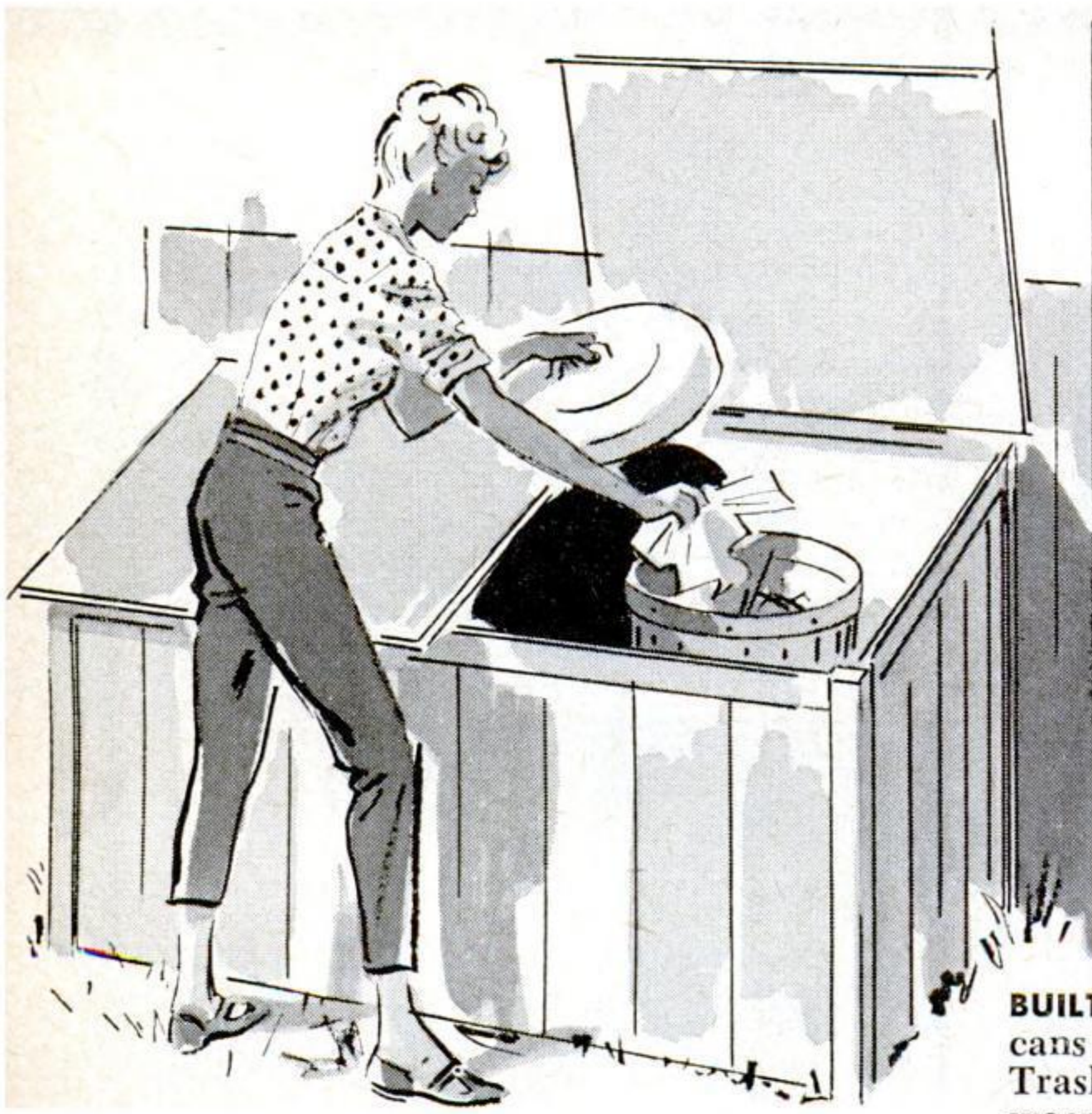
Camouflage them with paint. If the house is white, white enamel will make trash cans both less noticeable and more attractive. Paint the lower half of the cans the color of the foundation, the upper half the color of the siding.

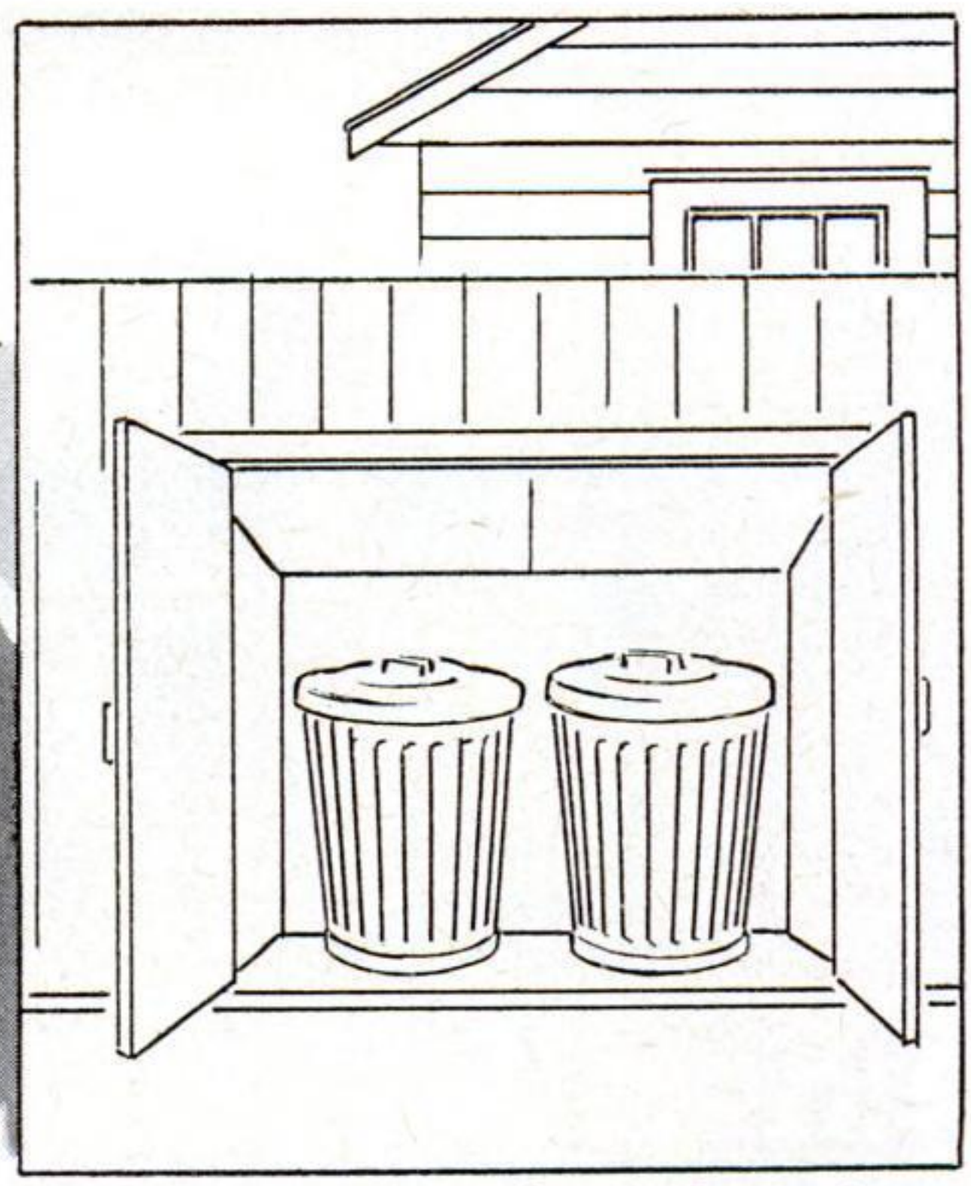
Paint adheres well to galvanized steel that has weathered for six months; or a special undercoater for galvanized metal can be applied first. Some manufacturers recommend liquid neoprene (rubber) as a protective coating for both the inside and outside of a can.

Where cans must be moved to the curb for collection, they can be stored on a low cart made of two-by-fours and screw-plate casters. Dollies for individual cans are easily built of two pieces of two-by-four crossed at the middle with a half-lap joint and fitted with screw-plate casters at the four ends. Reflective tape can be used to make cans readily visible and less likely to be bumped by cars. The tape can also be used to mark the cans with your name or house number so they won't be gone with the wind.



TWO-WAY COMPARTMENT built into the wall of a garage allows trash cans to be filled from inside, removed from the outside. Top of compartment serves as a shelf or workbench.





BUILT AGAINST A FENCE, this enclosure keeps cans at the street. For free plans, write for Trash Can Bin No. 54-490A, Douglas Fir Plywood Association, 1119 A St., Tacoma 2, Wash.

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Pittsburgh perfects a sensational new Latex house paint!

Easier to apply...even paints over damp surfaces... dries in 30 minutes...resists blistering...lasts longer

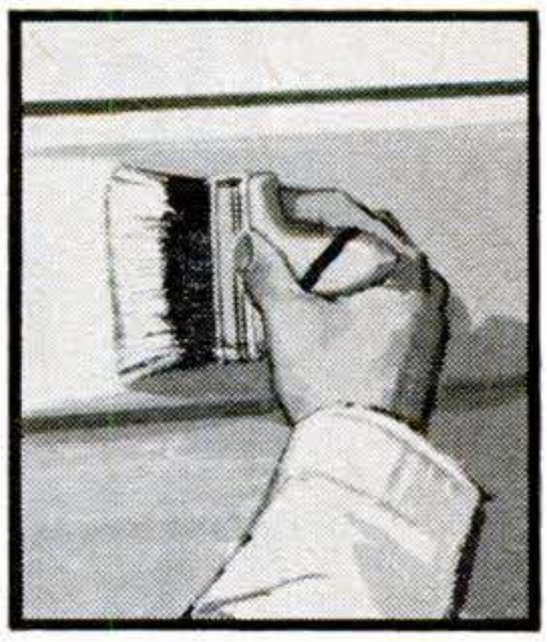
• **Leadership in research** pays off! After years of laboratory work and field tests in all parts of the country, Pittsburgh *perfects* an amazing new house paint —Pittsburgh Latex!

• **This new paint** is the greatest advance in paint development in years . . . gives you advantages in ease of application and durability never before thought possible!

• **New Pittsburgh Latex House Paint** is made from the same miracle resins that keep many of today's cars and appliances new-looking year after year! It can be used on wood, masonry, stucco, asbestos or metal surfaces.

• **Read below** about the remarkable results *you* can expect from new, *perfected* Pittsburgh Latex House Paint!

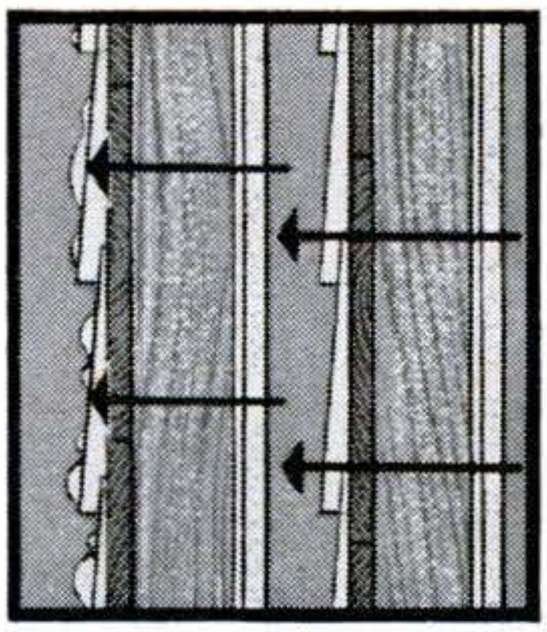
• **Sensational new Pittsburgh Latex House Paint** can keep your house looking "just-painted" years longer. The colors are fade-resistant ...white *stays* white, colors *retain* their crisp, clean beauty . . . and the new miracle resins are so durable they fight the effects of time and weather far longer! The result? A money-saving bonus of extra years between paint jobs!



• **You'll save hours** because Latex goes on so fast and smooth! No brush drag, no lap marks. Use brush, roller or spray.

• **Paint over damp surfaces!** With Latex you can paint over surfaces damp with dew or rain... or paint between showers.

• **Dries in 30 minutes!** Forget about rain, dust and insects messing up your paint job! Latex dries in only 30 minutes.



• **Resists blistering!** Correctly applied, Latex resists blistering. It lets trapped moisture *out*, yet will not let moisture *in!*

• **Clean up with water!** Cleanup and brush care is a snap! Just wash brushes, roller or spray gun in plain soapy water!

PITTSBURGH® PAINTS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

• For America's finest oil-base house paint, ask for Sun-Proof—famous for highest quality for 100 years.

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How to Reface an Old One

Every Home Deserves a Good Fireplace

How to Install One in Any Room

WANT a fireplace in your playroom, porch, attic, den, or bedroom? By combining a prefab chimney with one of the attractive metal fireplaces on the market, you can enjoy the cheer of an open fire in any room in your house for a few hundred dollars and a weekend of work.

Prefab chimneys in the form of circular, pipelike sections are available in several types. One of the newest, shown here, requires no mortar or other fastening—you just screw the sections together to make a chimney as tall as you need. The sections have an inner pipe of stainless steel 7″ in diameter and an outer one of galvanized steel 14″ in diameter with insulation in between.

Where can you put a prefab? The only requirement is that the chimney be kept at least 2″ away from wood or other combustible materials. You can run it up through part of a closet or tuck it in the corner of a room.

Because of its light weight, the chimney can be rested on any floor or ceiling without additional bracing. Special bases, T-shaped connectors, and other fittings are available to adapt the chimney to any situation.

You can have a second-floor fireplace

[Continued on page 184]

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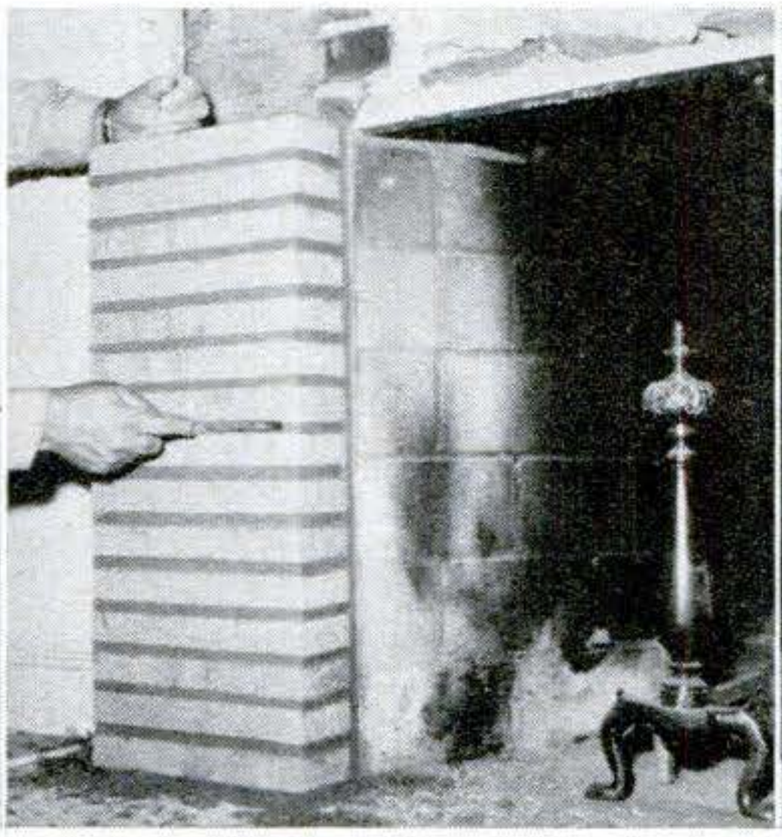
HERE'S how you can reface a massive, old-fashioned fireplace to suit modern furnishings. You don't need to tamper with the hearth, the firebricks, or the chimney. You remove and replace just what you can see—the facing materials.

The choice here was long Roman bricks and three pieces of marble, plus a new draw screen. The bricks and marble cost $68. Marble can be obtained cut and polished to your order. Local dealers can offer you other materials, too, and make suggestions about their use.

When the mantel is lowered, you have the problem of plastering the upper section. But this can be omitted if you take the out that was used here—covering the entire wall with paneling.

IT LOOKED LIKE THIS after the mantel was pried off. A cold chisel was then used to remove the stones one by one. It's important not to disturb the firebricks behind them.



NEW BRICKS are set up in a column at each side of the fireplace opening with a stiff mortar, one part portland cement to three parts' sand. Tool the joints as you go along.

TAP THE MARBLE gently with a soft mallet or a wood block as you set each piece into the mortar. Thick layers of mortar atop the twin brick columns help you level the mantel strip.

YOU CAN PUT A FIREPLACE ANYWHERE when you hook it to a prefab chimney. A metal roof housing (above, left) gives the circular flue sections the look of a real masonry chimney. Smartly styled prefab Acorn fireplace at right stands on its own legs, requires no mounting.

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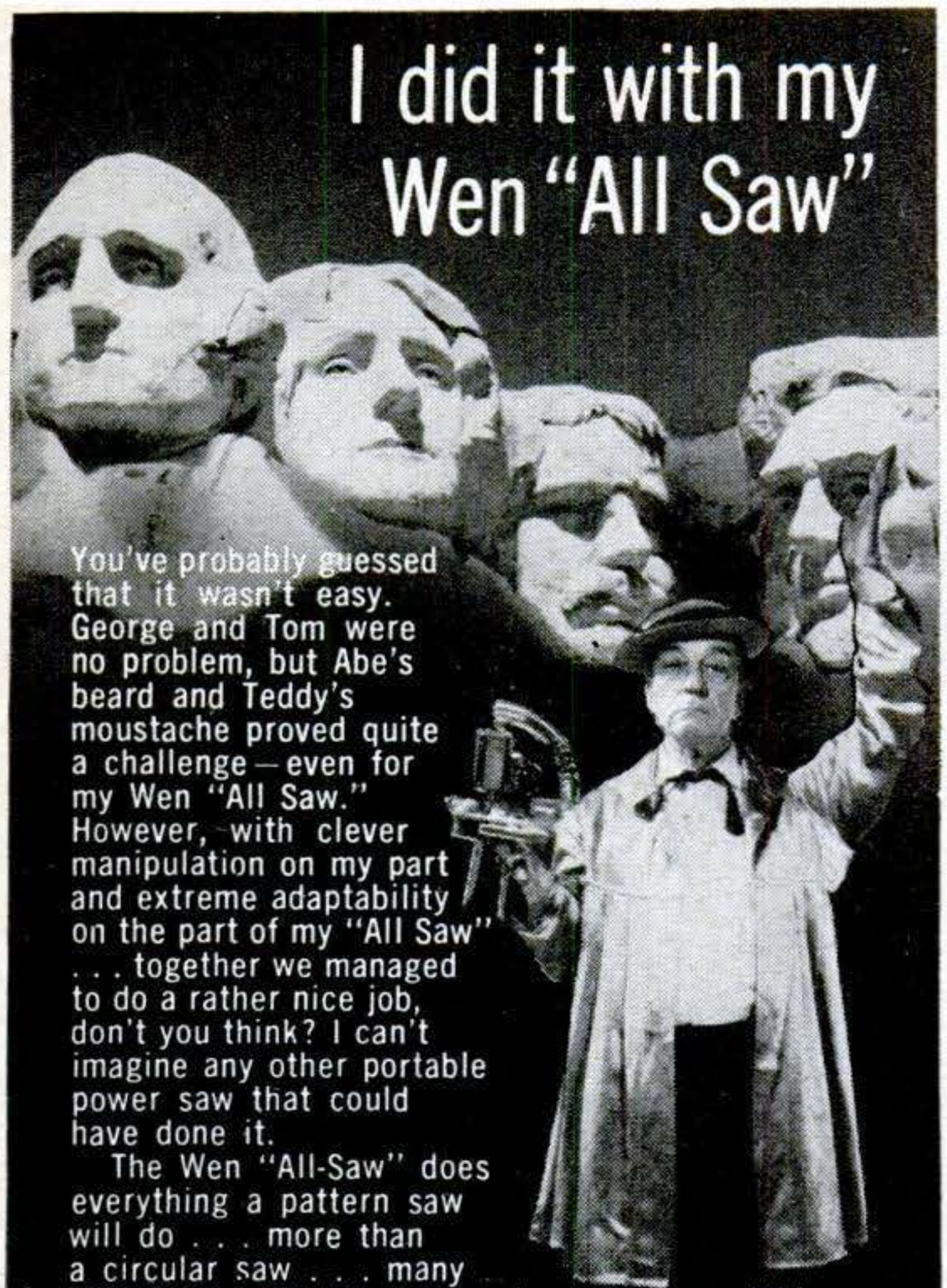
I did it with my Wen "All Saw"



You've probably guessed that it wasn't easy. George and Tom were no problem, but Abe's beard and Teddy's moustache proved quite a challenge—even for my Wen "All Saw." However, with clever manipulation on my part and extreme adaptability on the part of my "All Saw" . . . together we managed to do a rather nice job, don't you think? I can't imagine any other portable power saw that could have done it.

The Wen "All-Saw" does everything a pattern saw will do . . . more than a circular saw . . . many things normally done by a hand saw or nibbler—and many things that, until now, only a chain saw could do. In fact, the Wen "All Saw" will cut anything from a 6" log to intricate pattern work in wood, all metals, including steel thin gauge to ½", pipe and thin wall up to 2" in diameter. It cuts curves, circles, straight cuts or patterns in Masonite, Bakelite, tiles, formica, wallboard, Plexiglass, plaster-board, asbestos. Knife blade cuts anything normally cut with a knife—salami for example. It's perfect for home workshops—yet it's UL "Industrially Rated." You get 7 blades, a rip guide and a circle cutter at no extra cost.

Now, I ask you, from whom else but WEN could you find such a versatile power saw for only **$44.95?**

Buster Keaton

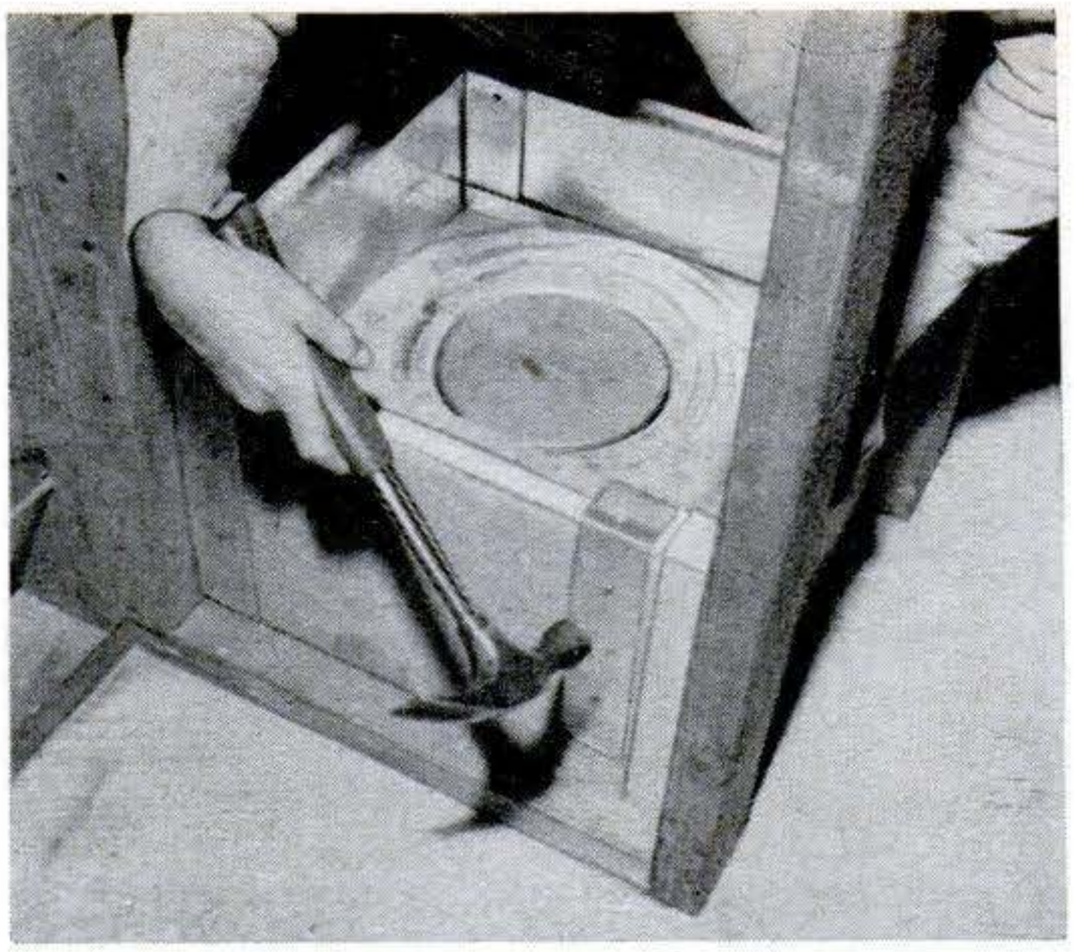
YOU CAN ALWAYS DEPEND ON NEWER AND FINER PRODUCTS FROM **WEN**

FINE FINISH SANDER—Light, handy and quiet. Powerful motor delivers 14,400 straight-line-action strokes per minute. Perfect for fine finishing and polishing. Strong black plastic case. Comes complete with 6 assorted abrasive sheets and 2 polishing pads. **$13.95**

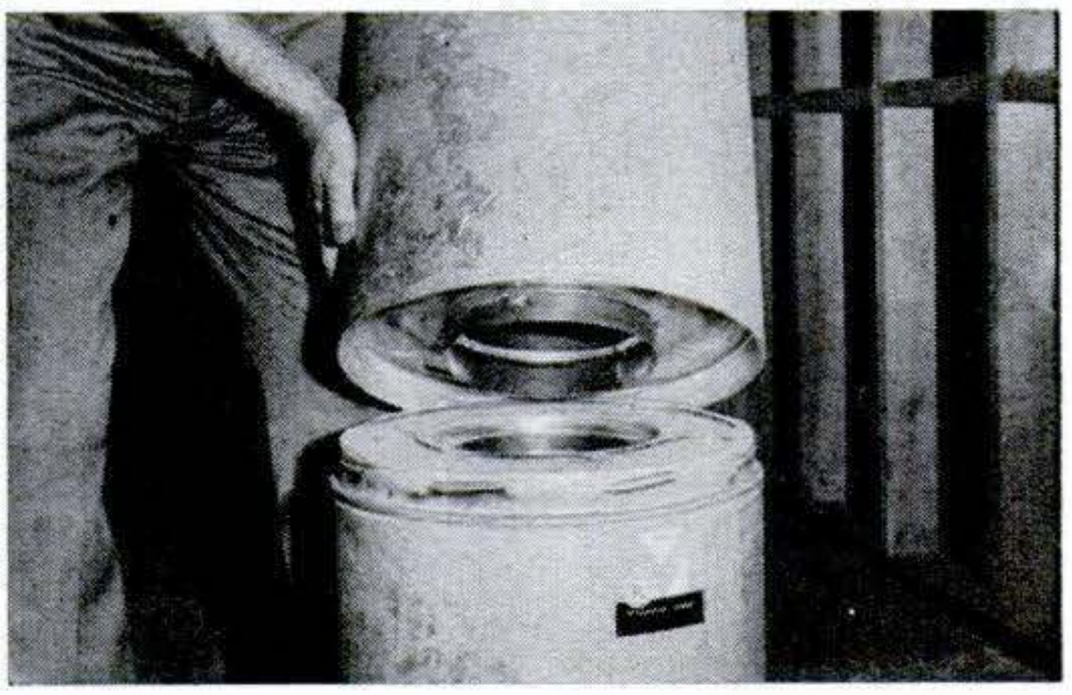
MULTI-PURPOSE SOLDER GUN KIT—Feather-light slim gun with 100 watts power. Heats in 2½ seconds. Built-in spotlight focused on work. The kit includes the gun, extra tips for hot-cutting, smoothing, and rosin core solder . . . all in a strong metal box for neat compact storage. **$7.95**

3/8" 2-Speed Power Drill.....**$29.95**
Lightweight Sabre Saw.....**$26.95**

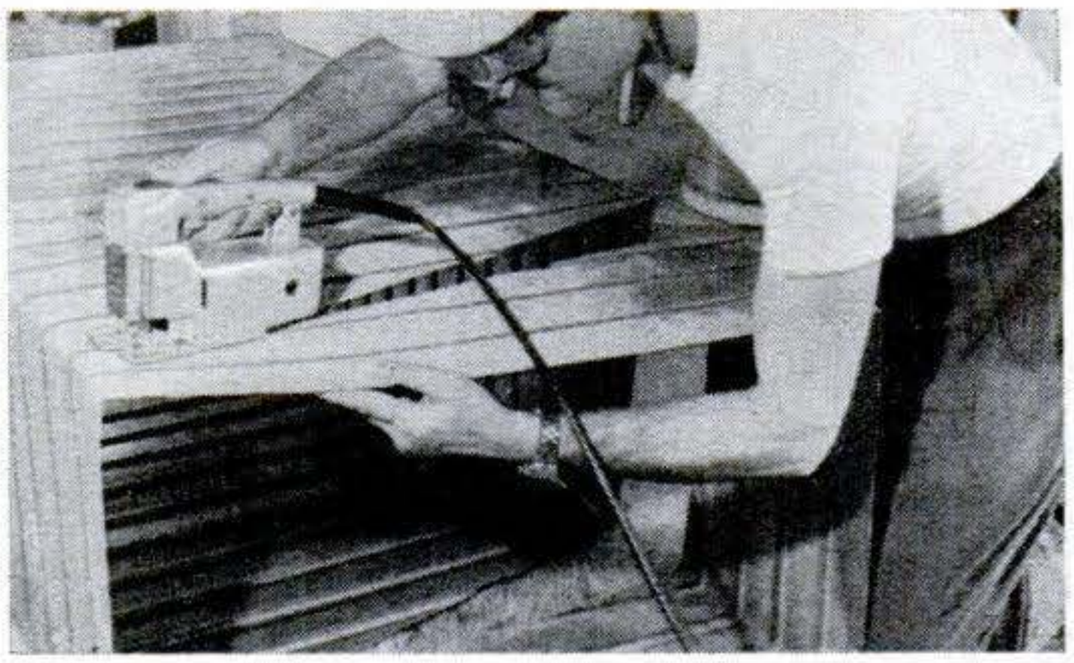
WEN PRODUCTS, INC., 5810 Northwest Hwy., Chicago 31, Ill.



YOU START WITH A BASE like this, nailing it directly to the floor or suspending it between ceiling joists. Circular flue sections are then built up on top of the base support.



YOU KEEP ON ADDING one section after another until you reach the desired height. The circular flue sections simply twist together and lock, requiring no mortar or other fastening.



CHIMNEY HOUSING is trimmed easily to match your roof slope with a metal-cutting saber blade or tin snips. Top must extend 3′ above roof on the high side and 2′ above roof ridge.

CHIMNEY CAP (right) has a long center pipe that extends down into the top flue section, locking the whole assembly rigid. The flue itself does not touch either roof or housing.

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by suspending the base of the chimney between the joists in the first-floor ceiling. Where the chimney passes through a floor, a metal collar nailed to the joists holds it away from the wood. Where it goes out through the roof, you need only an 18″-square opening—a rectangular metal housing covers the opening and gives the round sections the appearance of a real chimney.

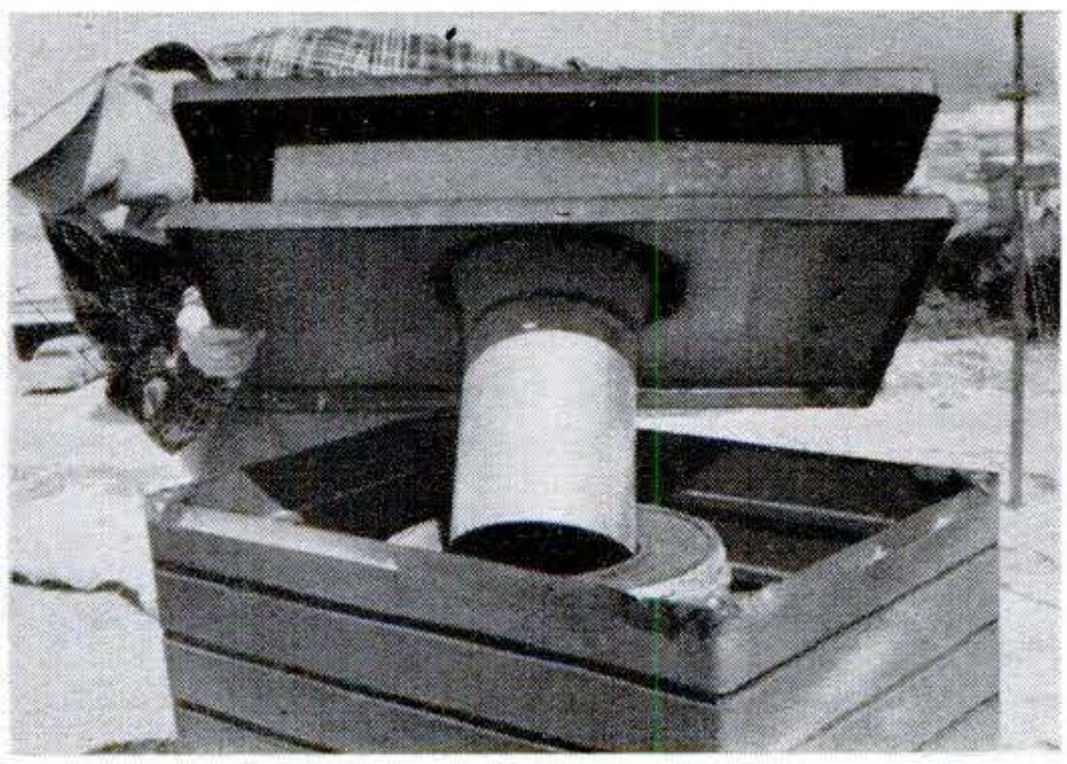
Mounting the fireplace. All prefab fireplaces come with a base or legs to support them—you make only one connection to the flue opening in the chimney. Over floors of concrete or other incombustible materials, no hearth is needed. Over wood floors it's best to put down a square of bricks or slate for safety reasons.

The chimney can be enclosed with any standard material so long as it's kept 2″ away. Where the fireplace joins the flue opening, surround the pipe with a collar of stone, masonry, or asbestos-cement board.

What they cost. The chimney sections come in 18″ and 30″ lengths that can be combined to give you the desired height. The sections cost about $7.50 a foot. The base, flue connector, and roof housing come to about $80 to $90, depending on the size of chimney housing you select. The housing is available in three heights —3′, 4′, and 5′.

The cost for the job shown here, requiring 9′ of chimney, came to about $160. The prefab fireplace itself added another $135, bringing the total to $295.

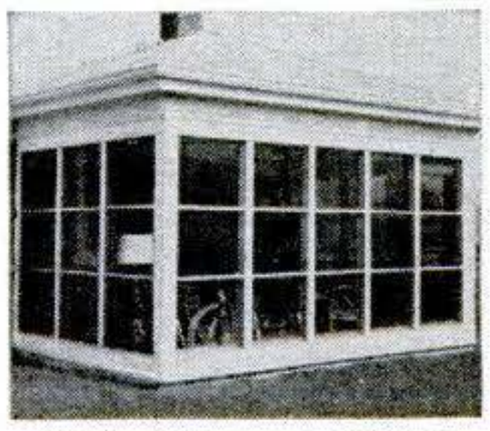
Prefab chimneys are now acceptable in nearly all communities, but it's a good idea to check with your own building department. The one pictured here is called "Metalbestos" and is available from the William Wallace Co., Belmont, Calif.



DOES AN INEXPENSIVE *"Living"* ROOM LIE HIDDEN IN YOUR HOME?

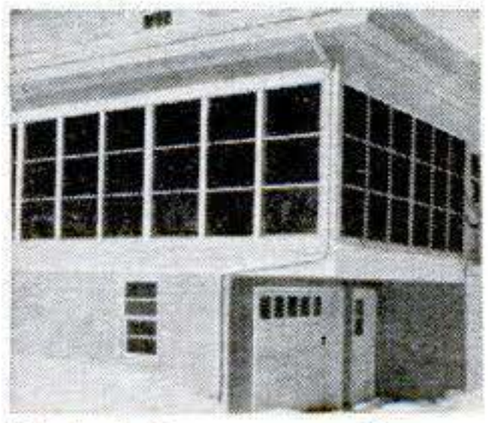
THERE is a good chance that the additional "Living" room your family needs or wants is *already half built* in your home. It may lie "hidden" in the form of an unfinished porch, a walk-out area over the garage or possibly an open breezeway.

Such hidden "treasures" are all you need for a start on inexpensive remodeling to year-round "Living" room when you use a unique "package" construction method incorporating GlassWall units manufactured by DeVac, Inc. Each GlassWall reaches from the floor to the ceiling, is complete with three adjustable glass panels and Fiberglas screens.



'Living' Room on Porch

'Living' Room on Breezeway



'Living' Room over Garage

Even building from the ground up this method often costs less than conventional construction. Rapid installation is possible using only normal carpenter's tools and complete step-by-step instructions from the manufacturer keeping final cost per square foot down. (Popular Science, Sept., 1959).

In the summer, with the sliding window panels open, you are cool from the breezes, you smell the air alive with the aroma of freshly cut grass and budding flowers. You are completely relaxed in a comfortable chair sipping a cool refreshment, infinitely proud of yourself.

In the winter, with the windows closed and the storm panels in place, the comfort remains the same. You are in that same chair sipping a cup of coffee remarking to your wife about how it seems the whole family "just lives" in the new room.

You are invited to write requesting a copy of a 12-page illustrated booklet showing how other families have gained inexpensive "Living" room which was hidden in their homes. Write for the "Let's go out on the porch . . . " booklet. DeVac, Inc., Dept. PS, 5900 Wayzata Blvd., Minneapolis 16, Minn.

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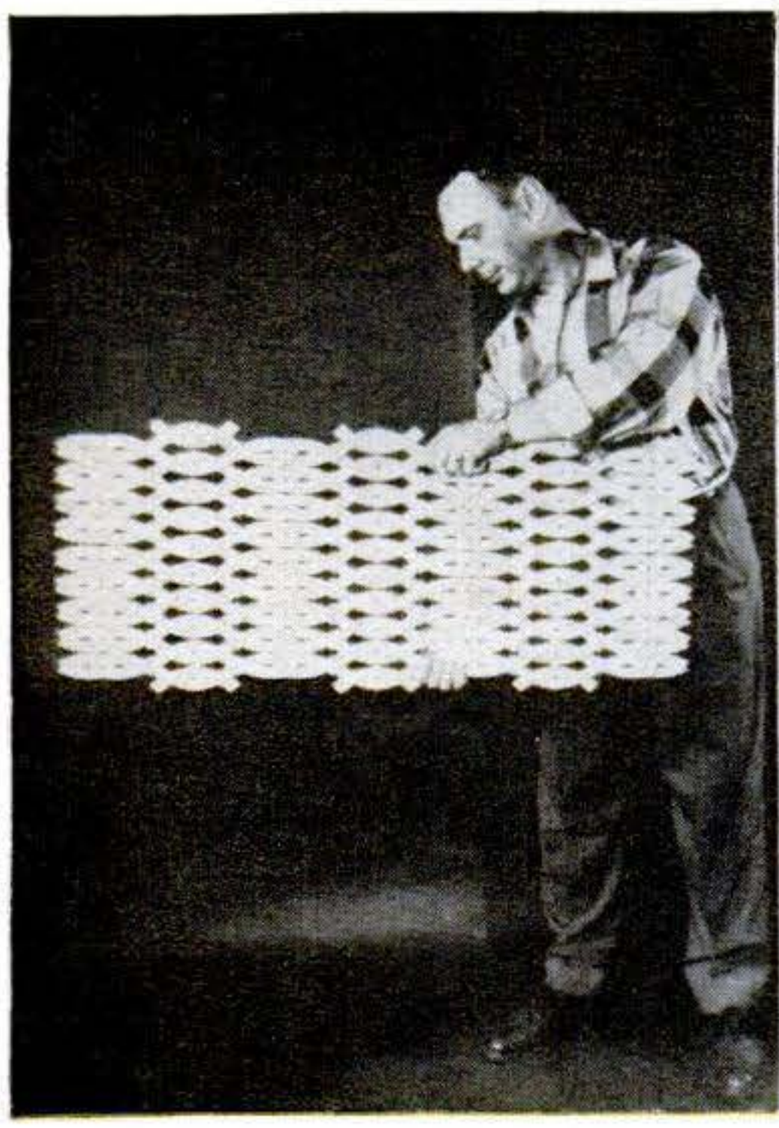

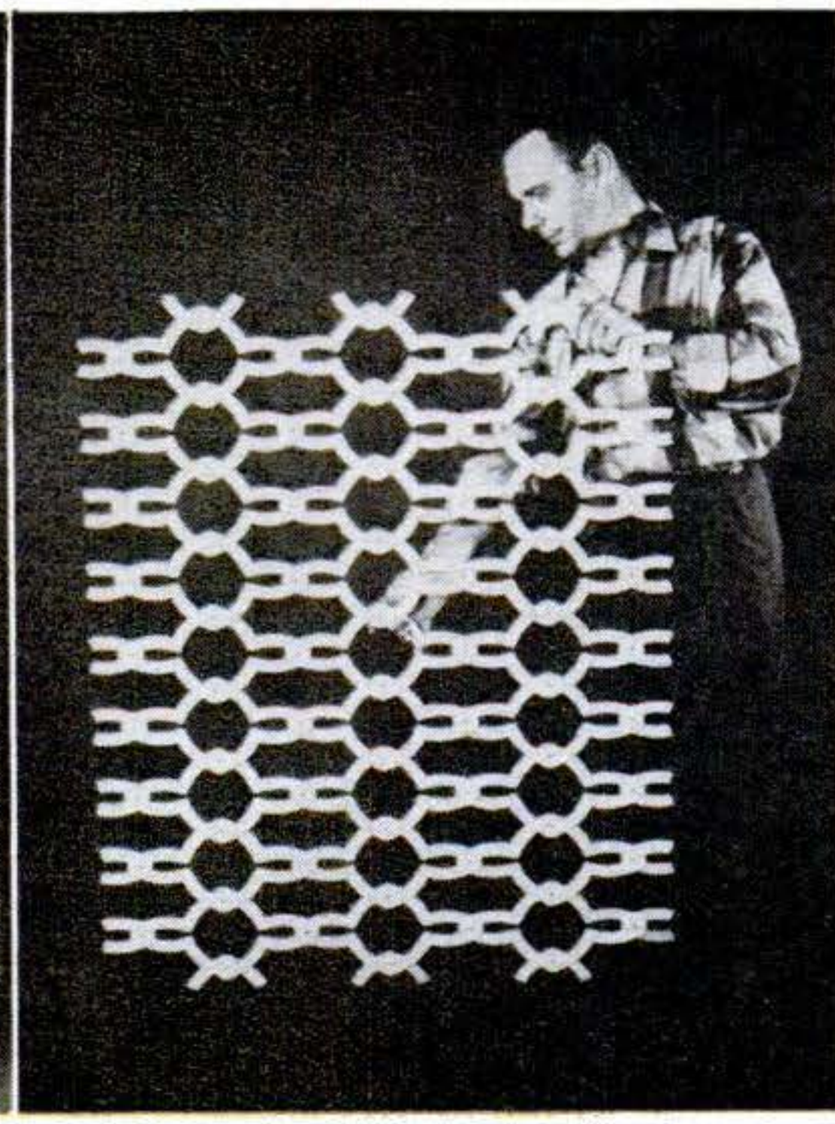

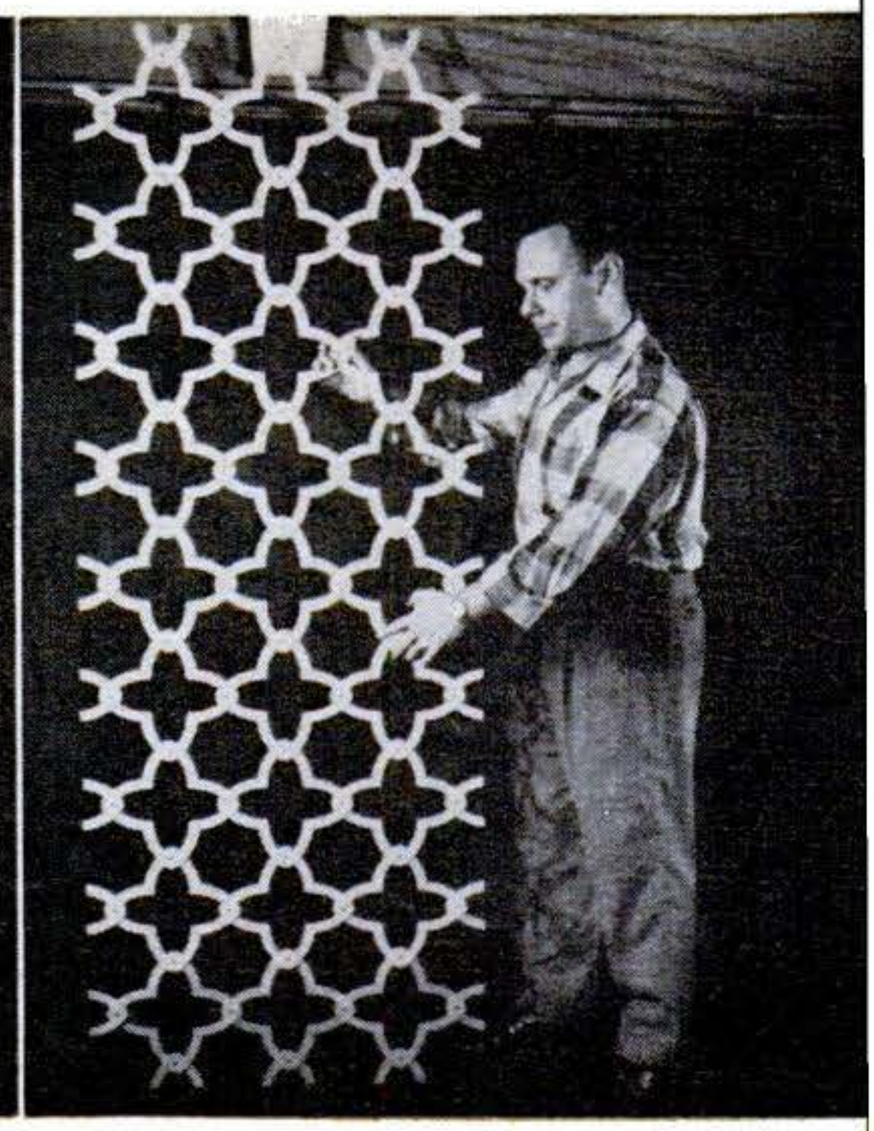

EXPANDING OR COMPRESSING the grille changes its looks as well as its size, as shown in the photos above. Two styles are available. Pattern 202 is shown in the drawings at left. The photos above and on the next page show Pattern 206.

It's made from ⅛" birch plywood:

Lazy-Tong

YOU can dress up a home in many ways with a new adjustable plywood grille. You can pull it apart or squeeze it together to create different designs and to fit various sizes of openings. Easily framed, the grille can be used for many eye-catching projects such as filigree-type folding screens, sliding panels, headboards, window cornices, shutters, and room dividers.

Called Expand-A-Grille, the new material is cut from ⅛" birch plywood and adjusts with a scissors-like, lazy-tong action. The cross strips are joined with tiny brass eyelets that serve as pivots.

The grille is available from U. S. Plywood Corp. in two patterns and three sizes. Size A varies from about 26" by 49" in horizontal expansion to 17" by 76" in vertical expansion. It sells for a little less than $6. Size B varies from 36" by 62" to 23" by 96" and costs just under $10. Size C—a jumbo 50" by 78" and 32" by 128"—costs about $22 and may have to be specially ordered.

Inch stock is usually used to frame the grille, often with a groove in one edge. A groove ⅜" deep cut on a table saw does nicely. Assemble three sides of the frame, slide the grille into the grooves, cut off any excess at the fourth side, and fit on the last piece. You can cut the grille with a fine-tooth saw or large shears. Toenail the grille ends.

A rabbeted molding can also be used, with a cap strip to cover the grille ends. A framing kit of this type is available from the distributors.

Grooved plastic channel with a pressure-sensitive adhesive backing is available for installing the grille against the face of a sliding glass door, a picture window, or the like. Write to Inter-Grille Mfg. Co., 519 Gwynn St., Babylon, N. Y., if this Flexi-Frame is not available from local dealers.

The grilles are made of unfinished wood and require a suitable wood finish after installation. They are not recommended for outdoor use.

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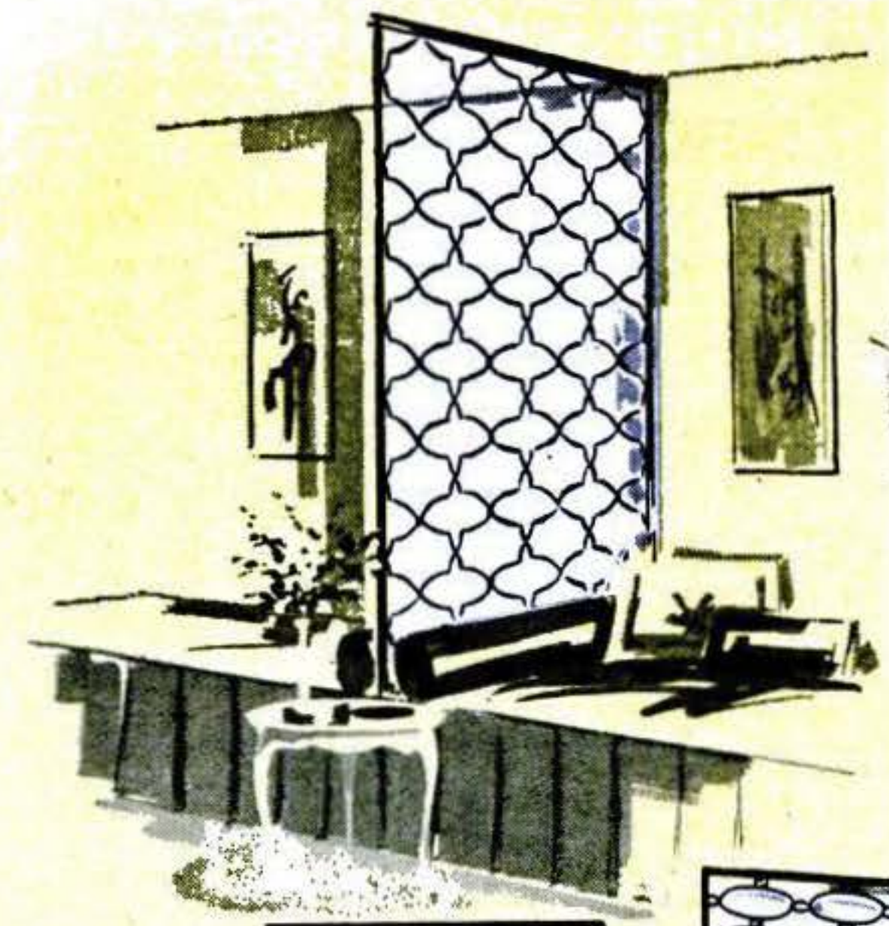
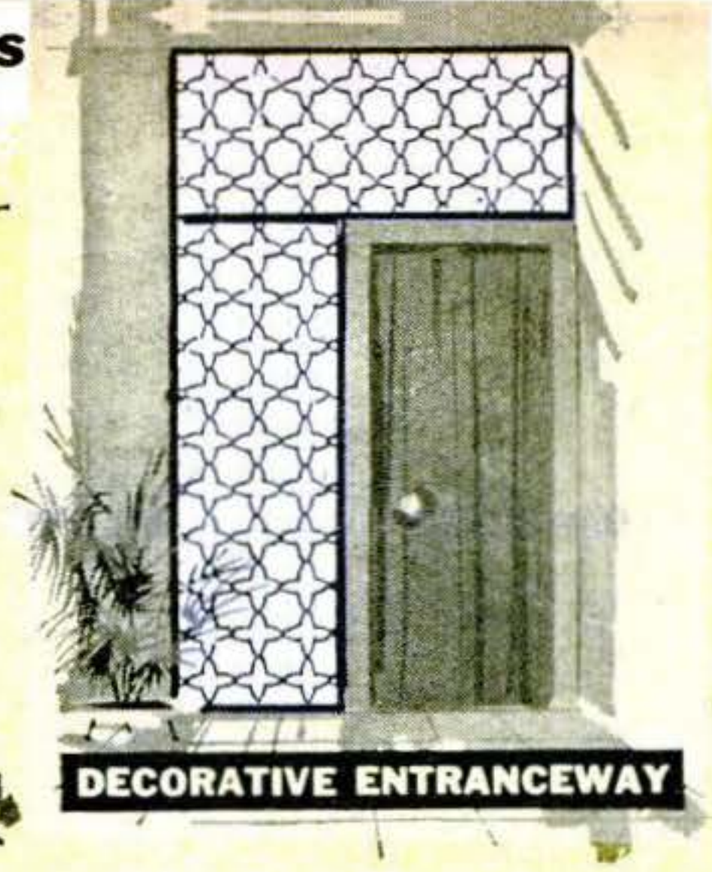
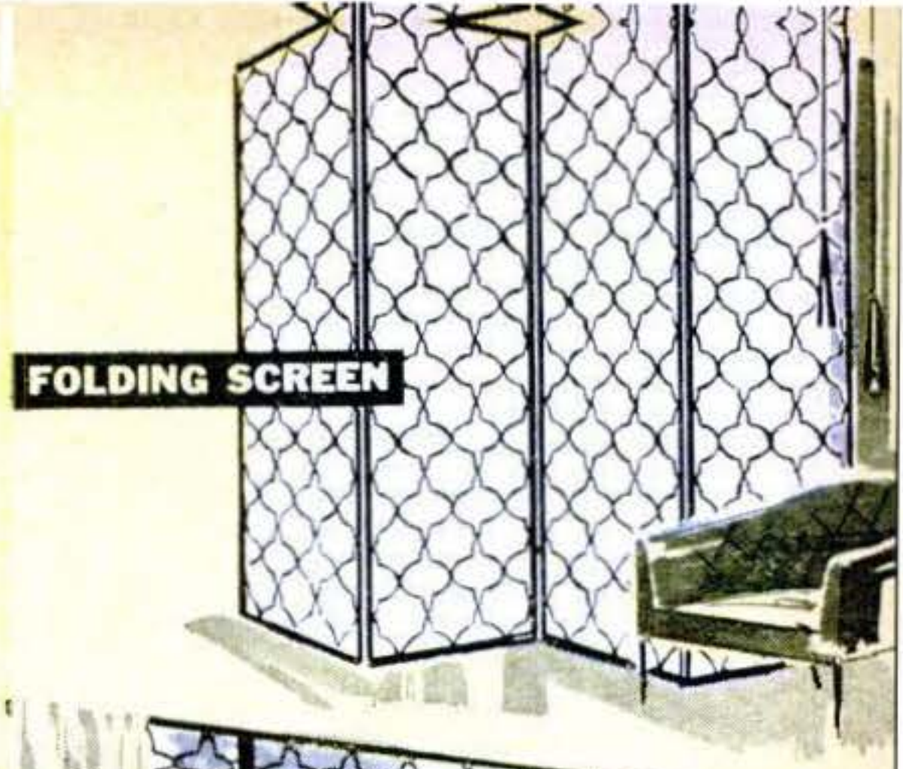
You can use the grilles in many unusual ways



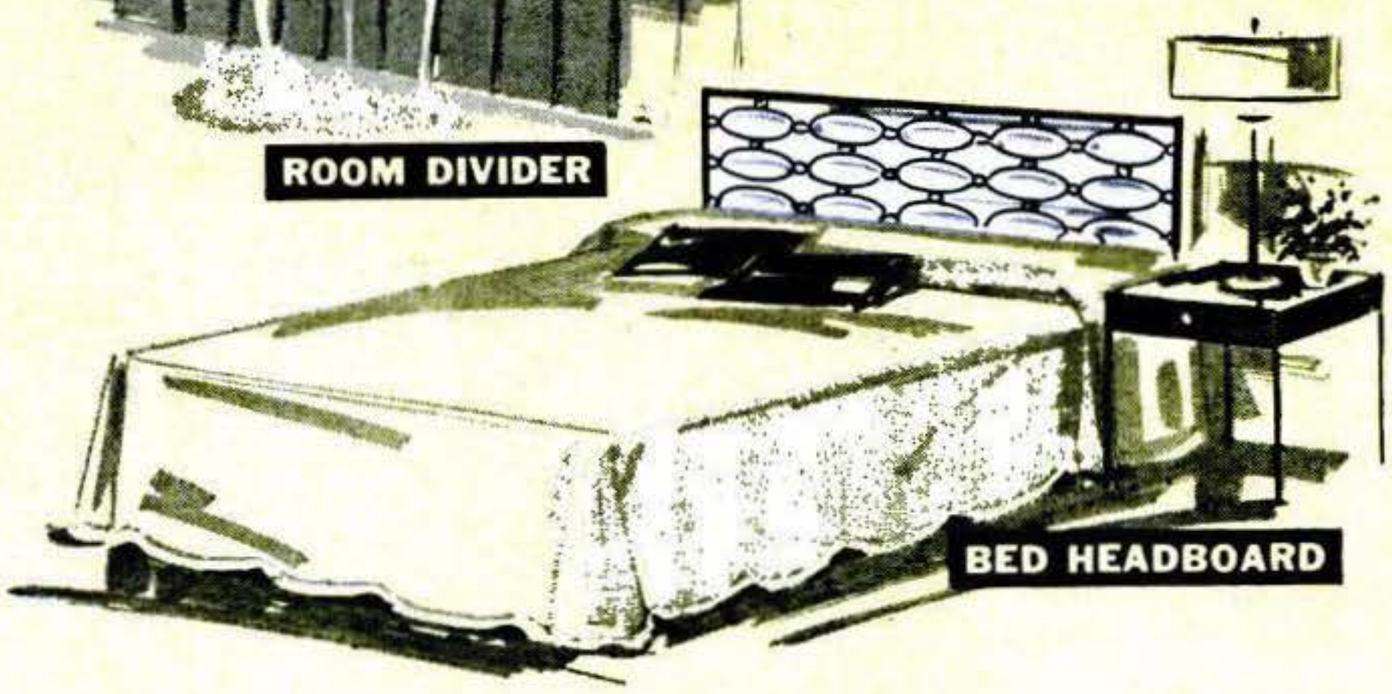
ROOM DIVIDER



DECORATIVE ENTRANCEWAY



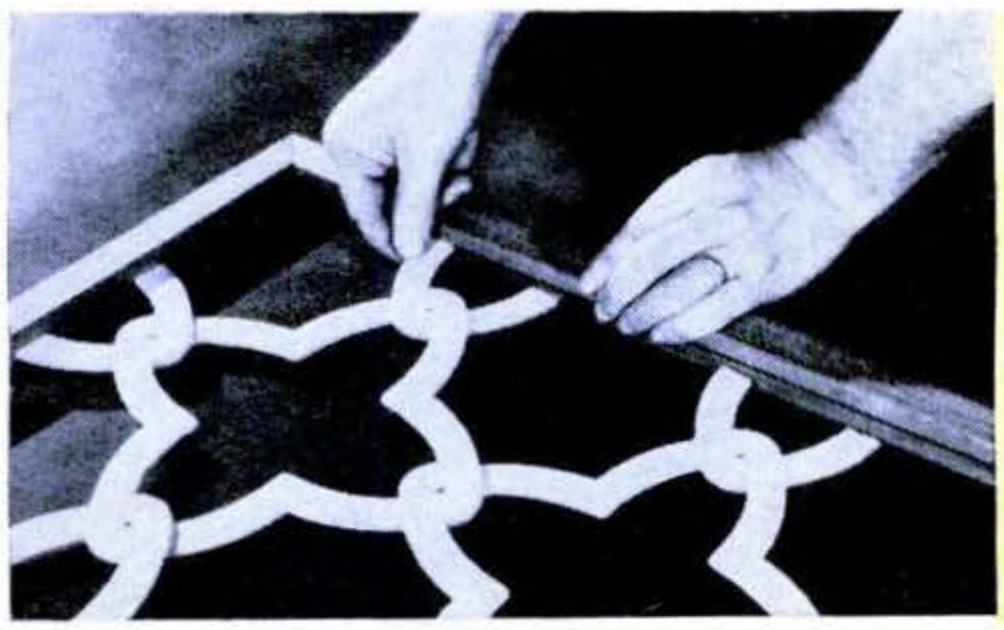
FOLDING SCREEN

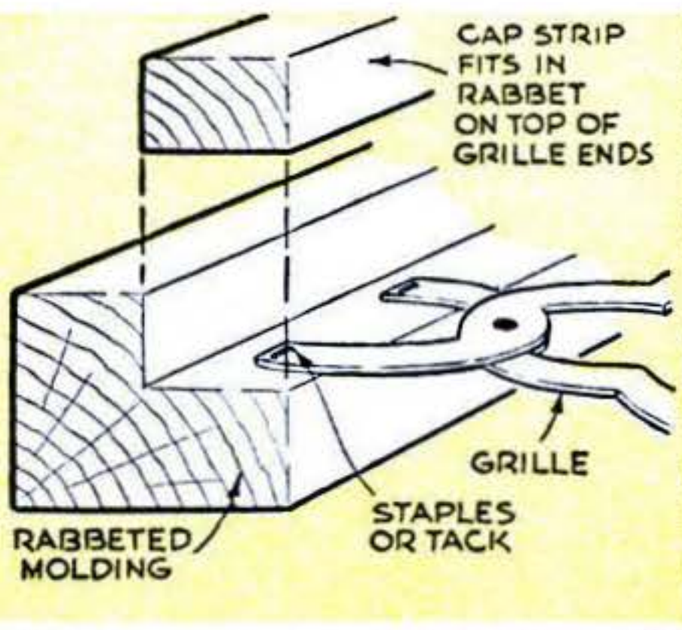


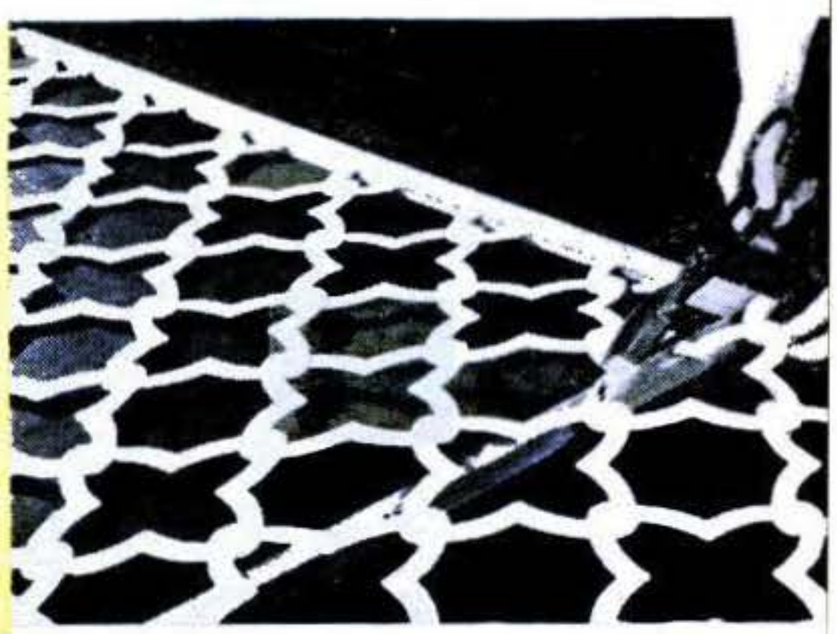
BED HEADBOARD

WINDOW FACING

Grillework for Home Decoration

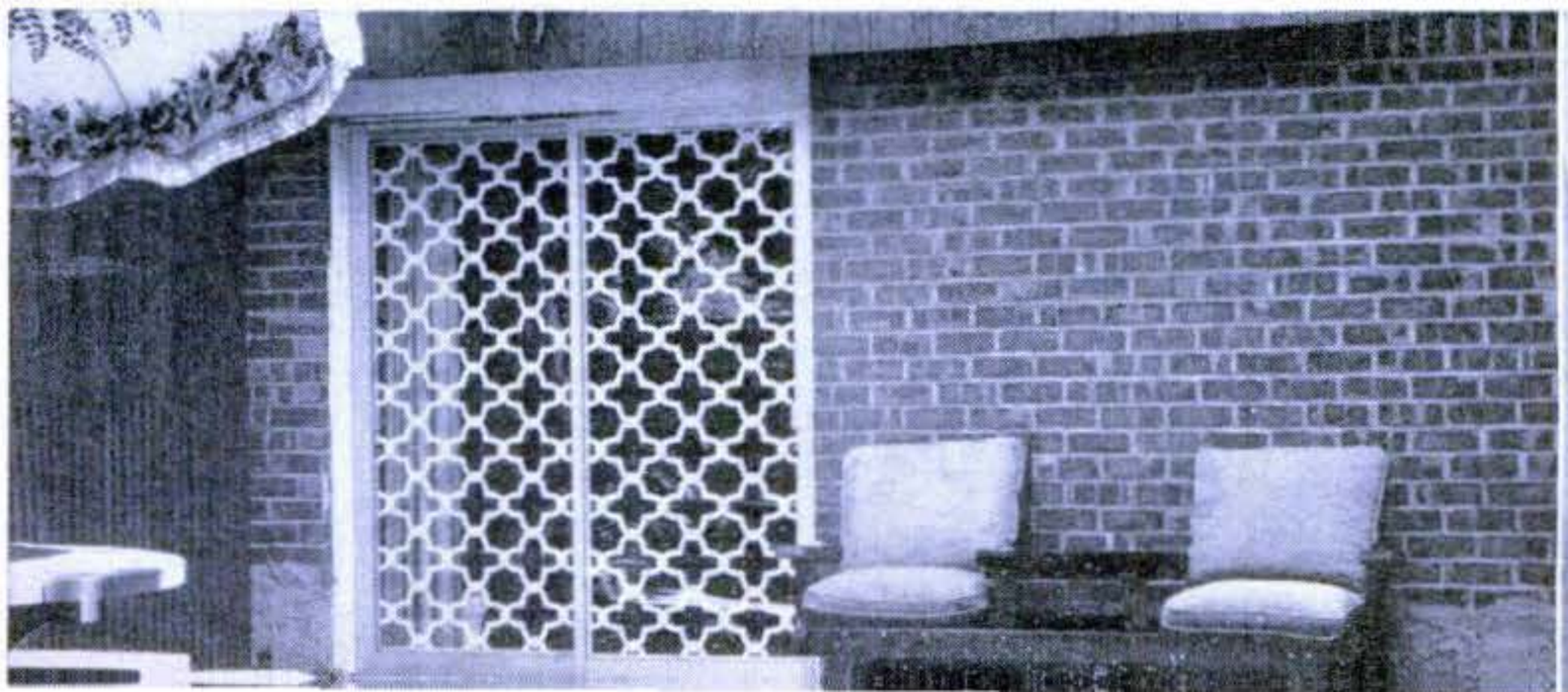






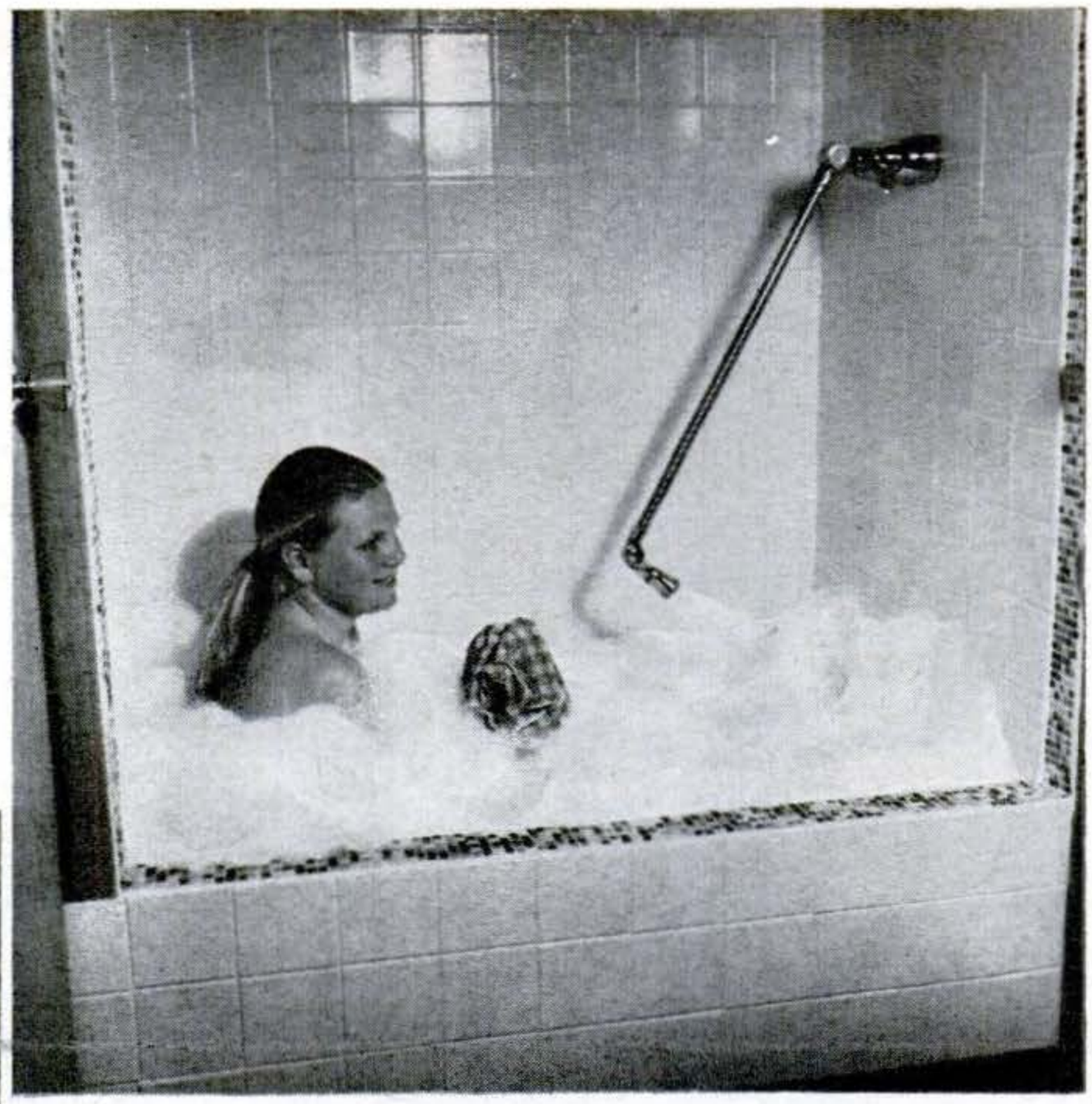
USING THE GRILLE is easy. Form it into panels with a frame made of grooved molding, as shown in the photo above, or with one made of rabbeted molding over which you place a cap strip, as in the sketch. You can cut the thin wood with scissors. Brad the ends in place.

PLAIN GLASS DOORS can be completely changed in appearance by installing the grille against them on the inside, as at left below. A channeled plastic stripping (below, right) is made especially for this. Its self-adhesive back fastens the strip to the glass or frame.

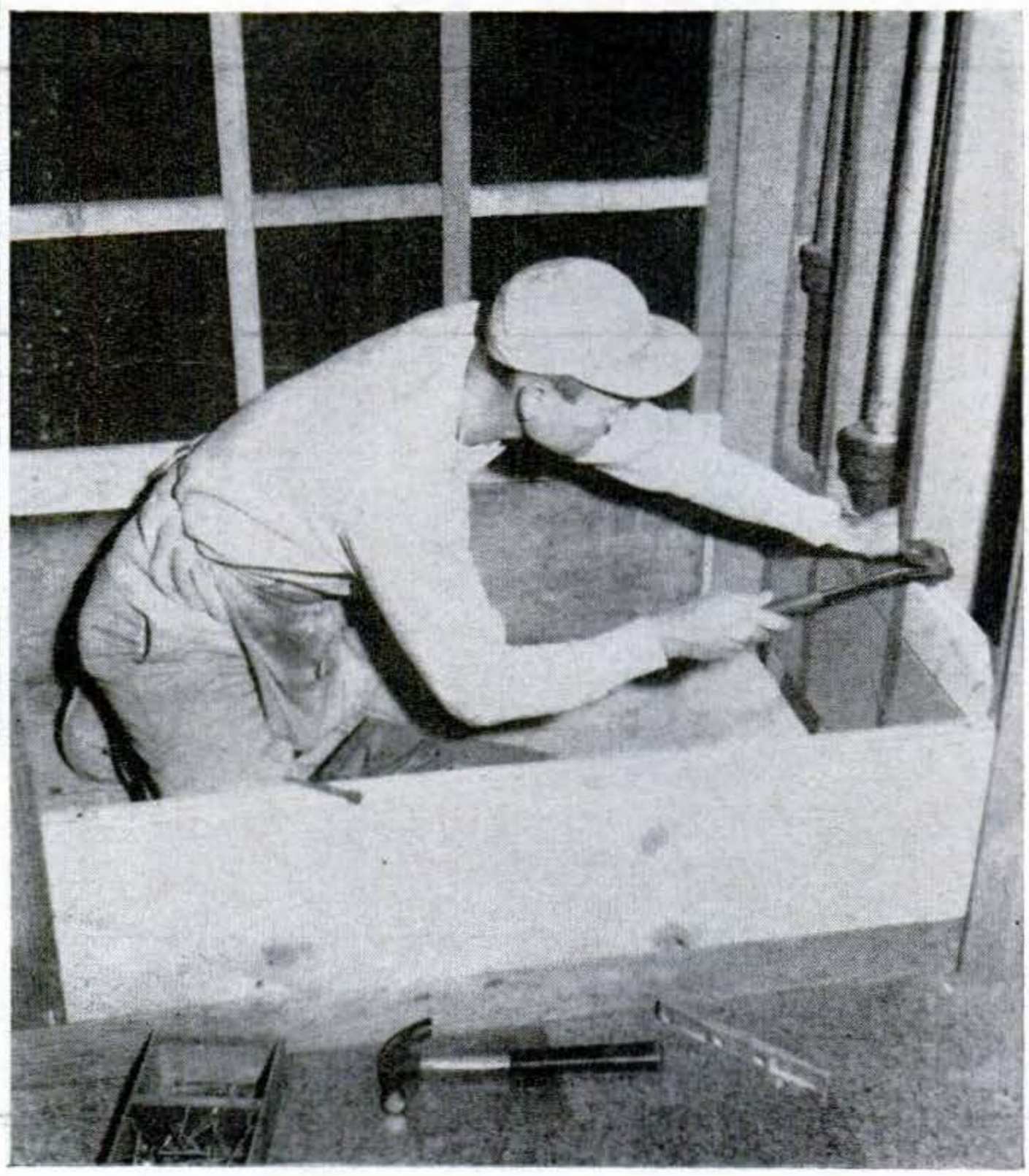


HOW TO INSTALL

A Tub in a Stall-Shower Space



AS A TUB, this two-way combination gives you a bath 4′ wide, especially good for youngsters. As you can see at left and above, the tilting shower arm adjusts to any height.



TUB FRAME is built up 15″ high with solid lumber or exterior-grade plywood. Two-by-four studs 16″ apart continue on up to the ceiling to form an enclosure 30″ by 48″.

WHEN you add an extra shower, why not make it a tub, too? A two-way combination like this gives you the luxury of both stand-up and sit-down bathing in a space not much bigger than a stall shower and without the cost of a conventional tub.

Basically, the design is simple: a slightly oversize

CONTINUED

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The price? A hard-to-believe $4.95—that's all! Your choice of Gray, Red or Green. Insist on a SWINGLINE staple gun—with push-button loading—at better hardware, department, stationery stores!

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SPECIAL SHOWER DRAIN has wide flanges that clamp the waterproof liner between them. Bring the drain pipe to 1″ below floor line, then screw on the lower half of the flanged fitting.

shower stall with a low wall across the front.

A waterproof liner forms a one-piece leak-tight bottom for the tub. It's available in polyethylene plastic or asphalt-impregnated paper. The type used here is asphaltic paper. It comes in rolls 60″ wide. A piece 78″ long makes a good-size tub 30″ by 48″ and costs in the neighborhood of $9.

You fold the liner into a rectangular tray about 15″ high and place it at the bottom of the tub. Over this you lay wire mesh and a bed of mortar for setting ceramic tile.

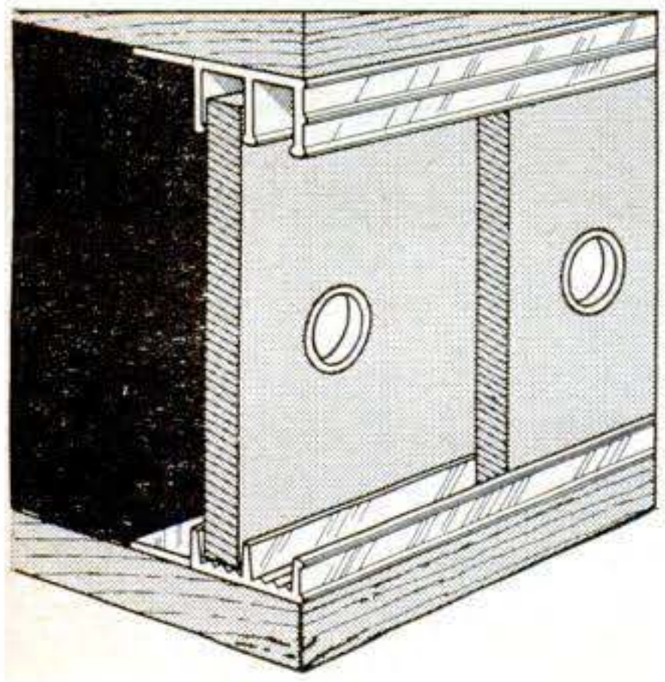
The enclosure shown on these pages was tiled all the way to the ceiling, but this isn't necessary. To cut the cost, other materials, such as panels of plastic-faced hardboard or imitation tile board that comes in sheets, can be used above the level of the tub.

Setting the tiles. As a backing for the tiles, a solid wood frame encloses the tub area, with ½″ plasterboard over studs for the walls above. One caution: For maximum watertightness, the tiles that form the tub should be set in regular cement mortar. For the walls above the tub you can use easier-to-apply ceramic-tile mastic.

Before setting the tiles, soak them for 30 minutes in a pan of water to keep them from absorbing moisture from the mortar. Soak only those tiles you'll use with mortar. For mastic installation, the tiles should be dry. Tile dealers will lend or rent you a tile cutter.

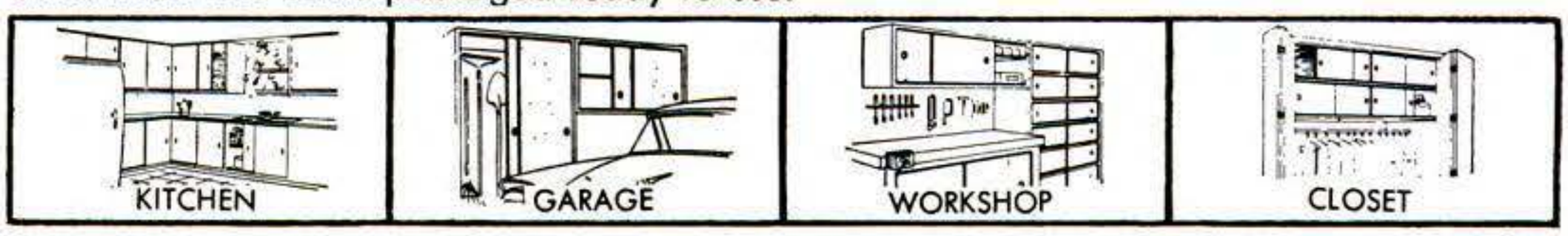
The edges of the enclosure along the

You Can Build Sliding-Door Cabinets Easily—

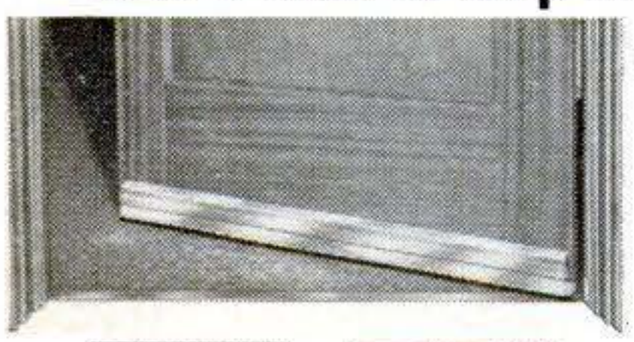


m-d **Aluma-Slide** SLIDING DOOR TRACK

Build cabinets the professional way. Aluma-Slide makes you an "expert" at installing sliding cabinet doors with smooth, finger-touch action. It's simple and fast. No special tools needed. Use plywood, hardboards, perforated panels from ⅛ to ¾-in. thick. Gleaming, aluminum Aluma-Slide track sets come packaged ready to use.



Here's how to stop under-door drafts!



RAISES WHEN DOOR OPENS

LOWERS WHEN DOOR CLOSES

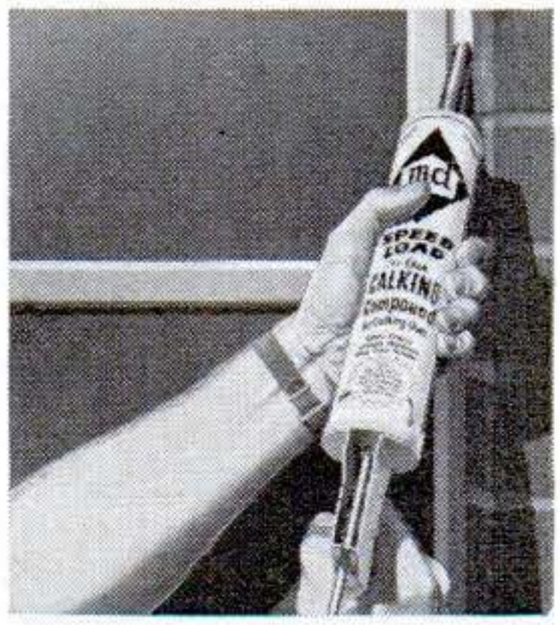
m-d *Nu*-GARD AUTOMATIC DOOR BOTTOM

Thick felt strip clears rug automatically when door opens. Lowers to make snug fit when door closes. Easy to install.

Fill those cracks!

m-d *Nu*-CALK SPEED LOAD CALKING COMPOUND

Won't dry out, crack or run! Easy-to-use M-D Speed Loads fit any gun. Color is white or off-white. Can be painted to match trim. Also in handy Squeeze Tubes for small calking jobs.



Available at Hardware and Lumber Dealers

MACKLANBURG-DUNCAN CO. OKLAHOMA CITY, OKLAHOMA

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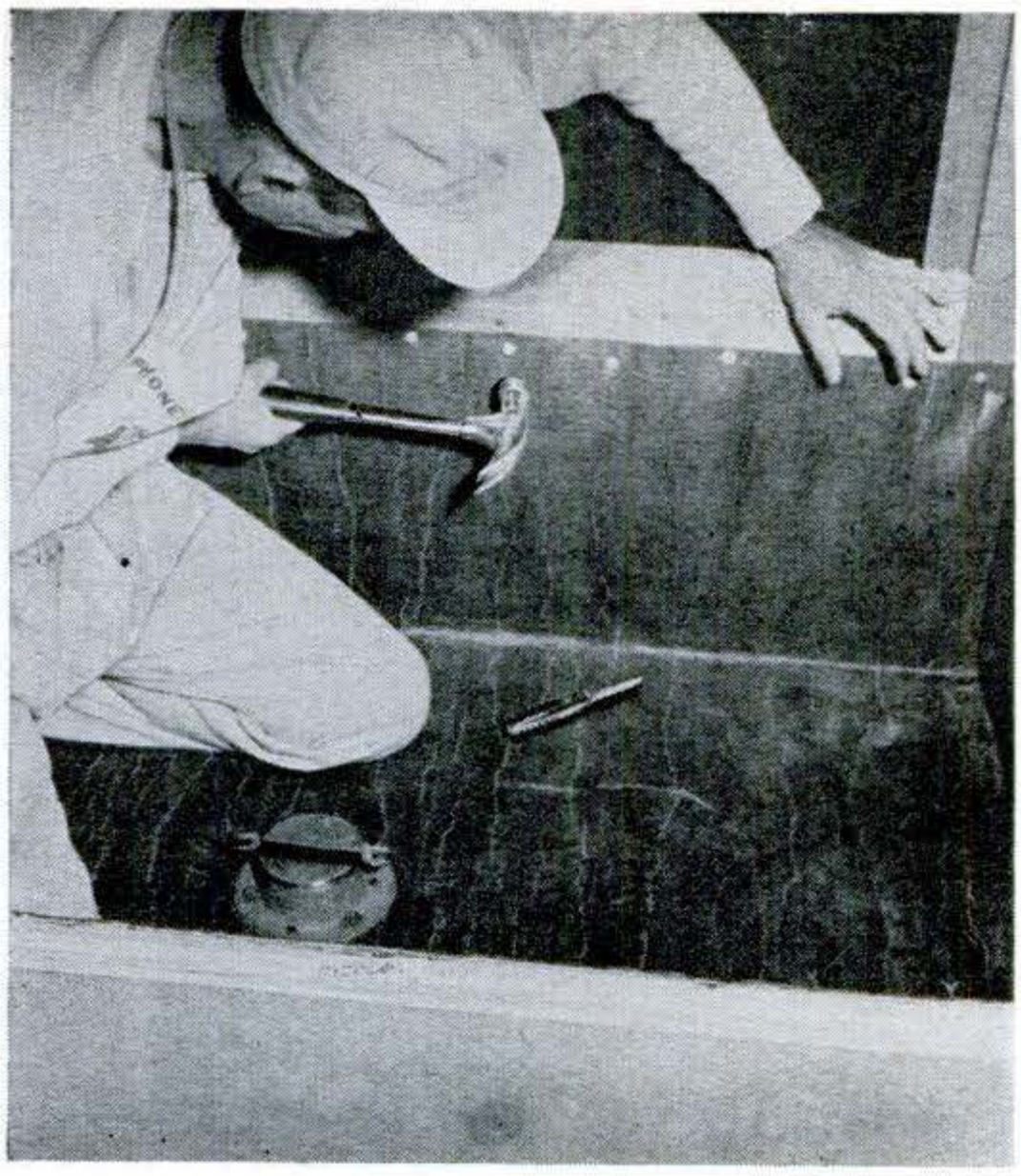

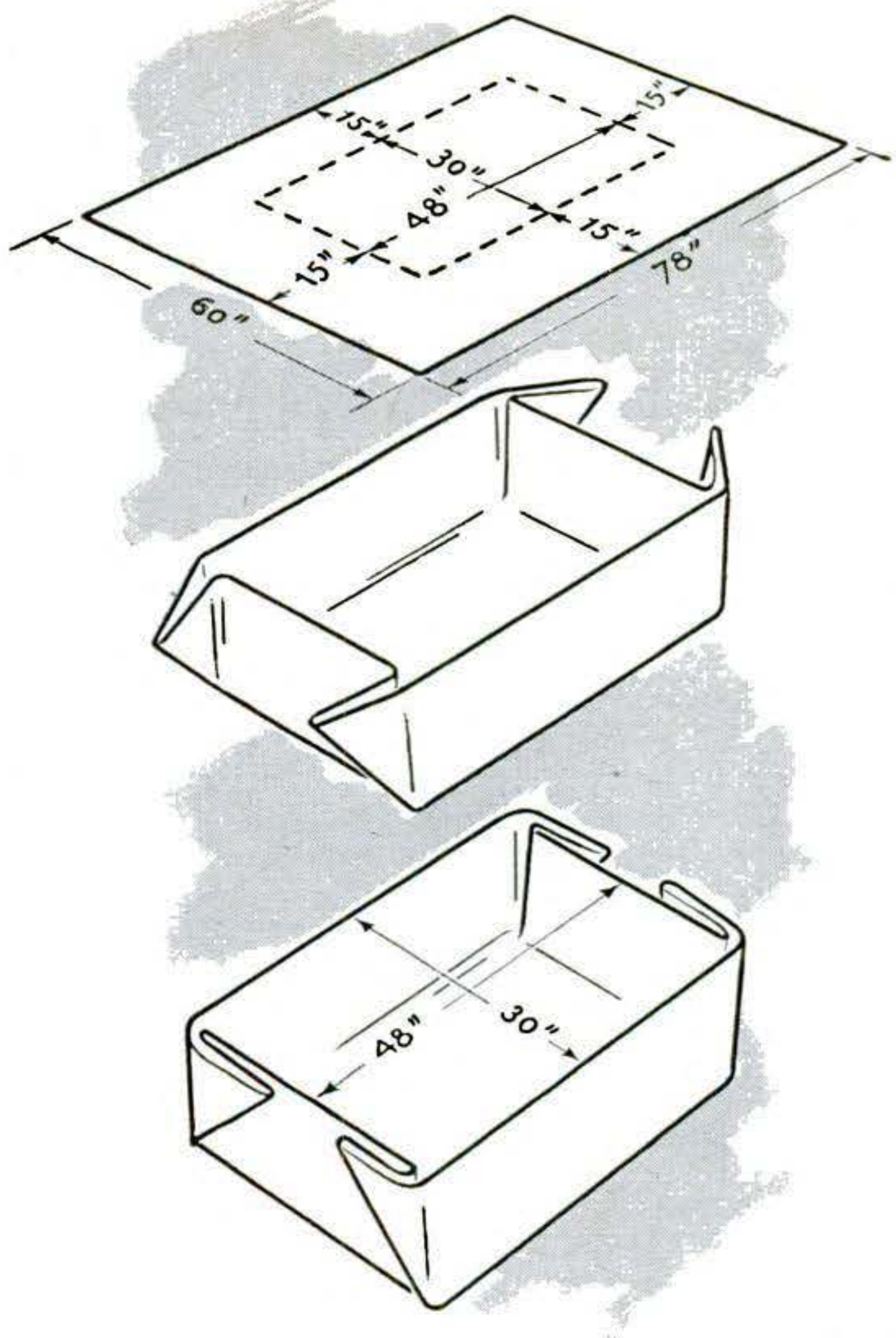

WATERPROOF LINER is nailed directly to the wood enclosure with broad-head, galvanized nails. Liner is formed into a tray shape from a single piece 60" wide and 78" long. Sketches at right show how corners are folded back against ends, forming watertight seams. Small hole is cut in the center of the liner, and the top half of the flanged drain is bolted to the lower half.

CONTINUED

BUILD THE HOME YOU WANT-

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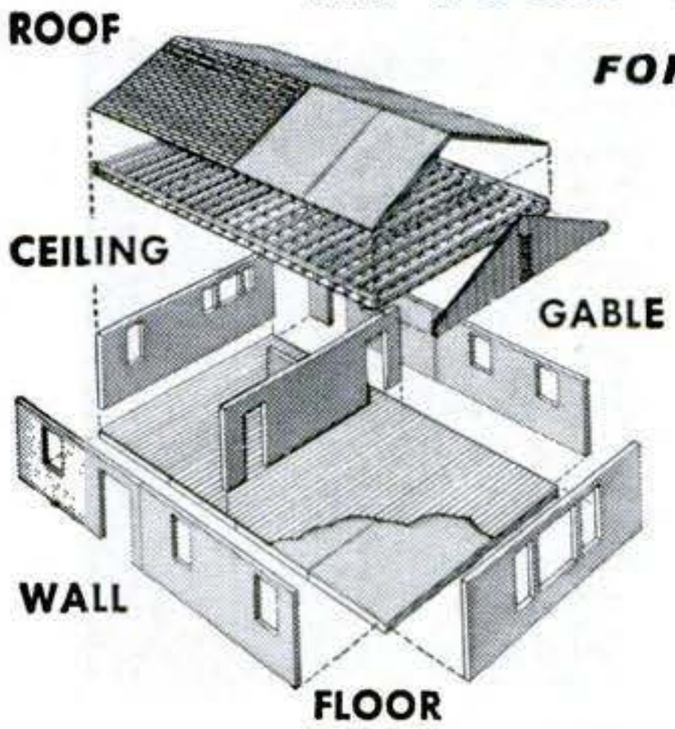

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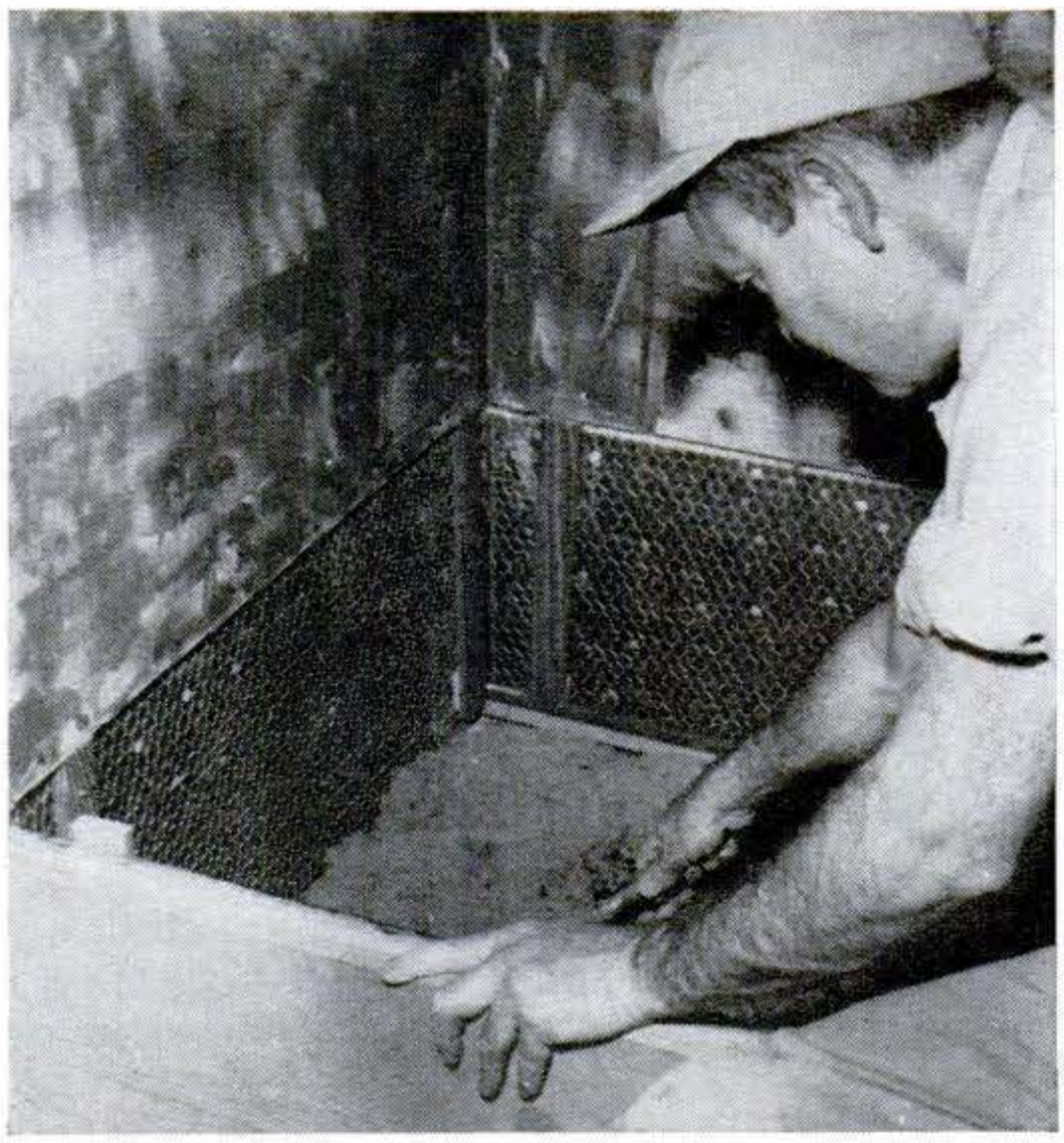
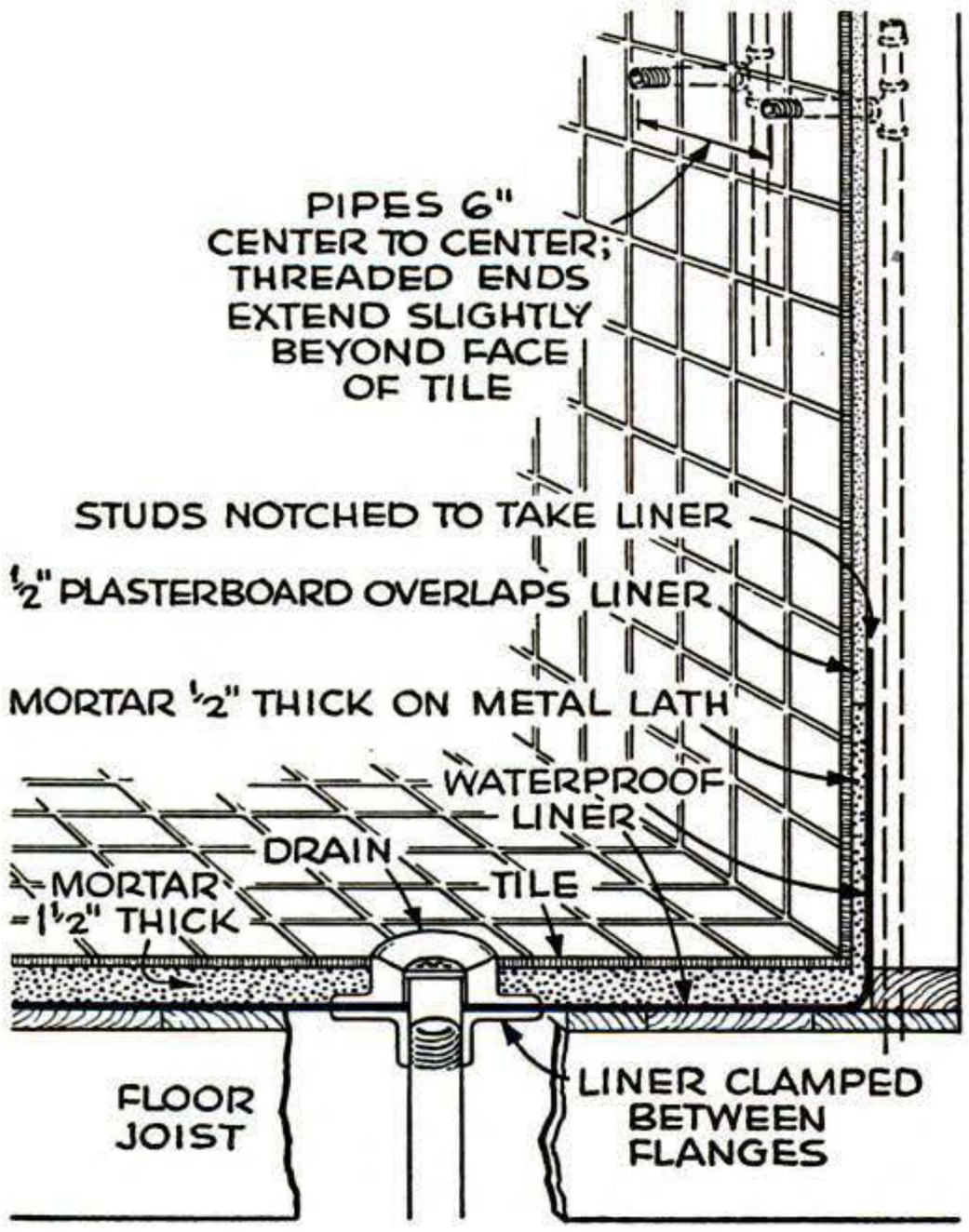
sides and across the top of the front wall are trimmed with small mosaic tiles that come mounted on cloth mesh for simple installation. Easy to cut into strips and cement on, they avoid the nuisancy prob-



WIRE MESH is stapled to sides and bottom of the tub over the liner. Mortar is then troweled on. Screed sticks, tacked on and removed later, help you keep mortar to a uniform thickness. Bottom of tub should slope slightly from sides toward drain at center. Drawing below shows how the waterproof liner fits into notched studs and is overlapped by plasterboard walls.



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lem of finishing off the large tiles at the edges.

Add a two-way fixture. One of the newest—and nicest—pieces of bathroom hardware is a pivoted shower arm that can be adjusted to any height. It's perfect for double use as either a shower head or tub filler.

The arm is about 28″ long and should be mounted at least 30″ above the top of the tub so it can't swing down and touch the water—a violation of the plumbing code.

The fixture shown here is called the Queen Mary Adjusto and is available from Milwaukee Faucets, Inc., 301 E. Reservoir Ave., Milwaukee 12, Wis.

Another special fitting you should know about is a two-part flanged shower drain made especially for use with the waterproof liner. The flanges squeeze the liner between them, making a watertight joint. While the drain has no shut-off valve built into it, you can get around this easily by covering it with a flat rubber sink stopper when you want to use the shower enclosure as a tub and fill 'er up.

TILES ARE LAID in bottom first, then carried up sides. Use a wood block, tapping lightly, to set tiles firmly. Walls can also be tiled, or another material can be used above the tub rim.

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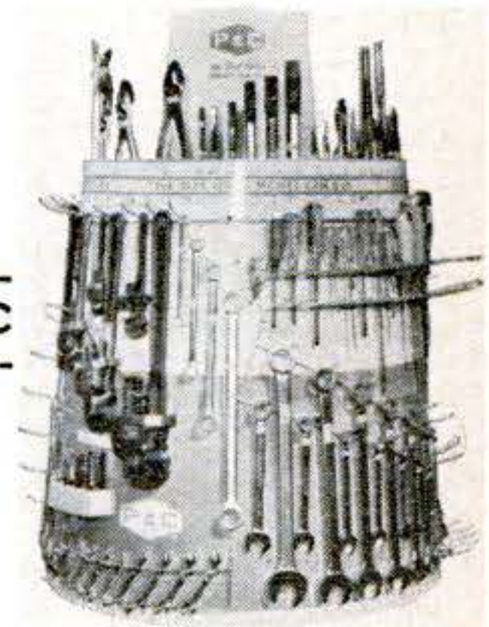

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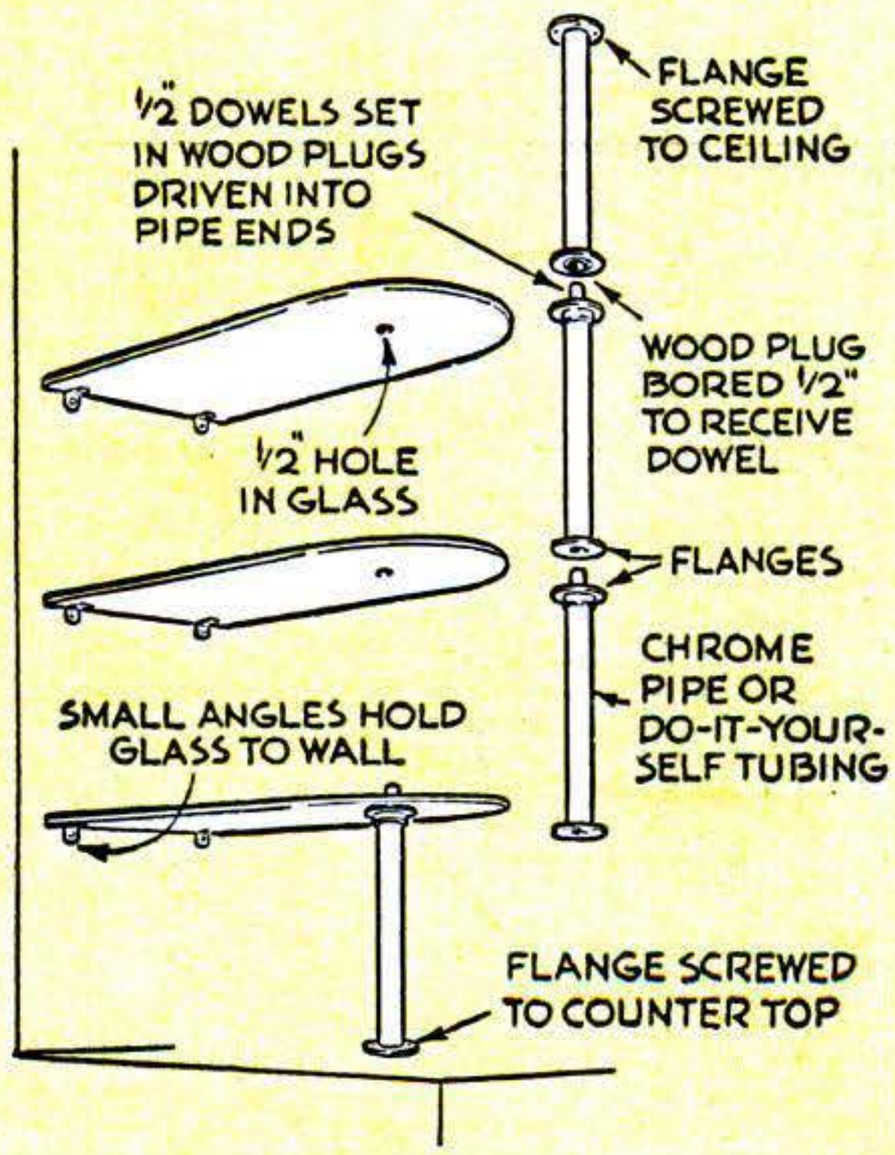
The Things You Can Do with Glass

GLASS is one of the most versatile materials for improving a home. Today you can get it in a variety of patterns and finishes that let in light, yet shield you from prying eyes; give a feeling of openness, yet keep out cold or heat. Installed as patterned wall panels, it is a material of real beauty.

Glass also has strength: Corrugations, ribs, and embedded wire make it an ideal structural material. Here are some of the many ways you can use it.



GLASS SHELVES are always attractive. Make the upper ones by assembling sections of chrome pipe or do-it-yourself tubing with dowels through glass, or buy sectional shelf supports. Small angle brackets anchor the glass to the wall.

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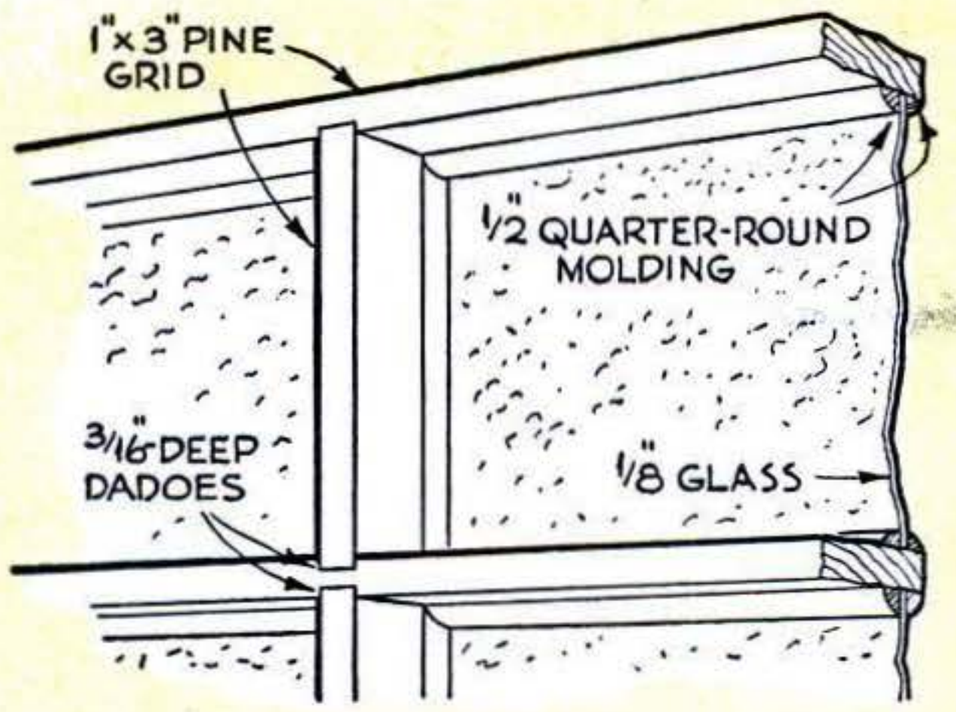
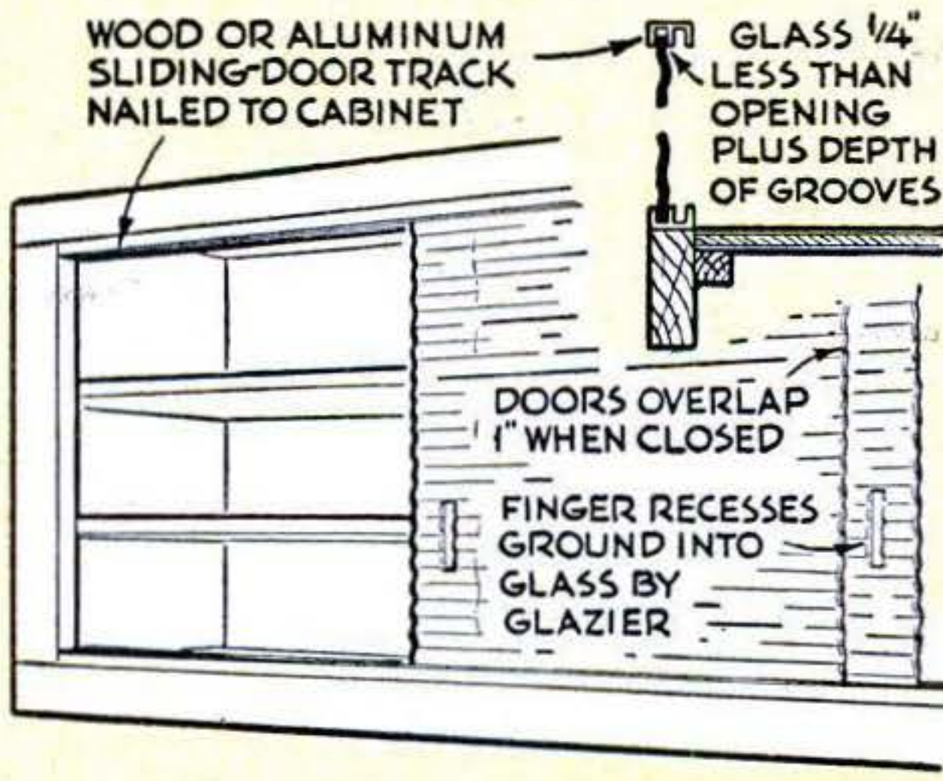
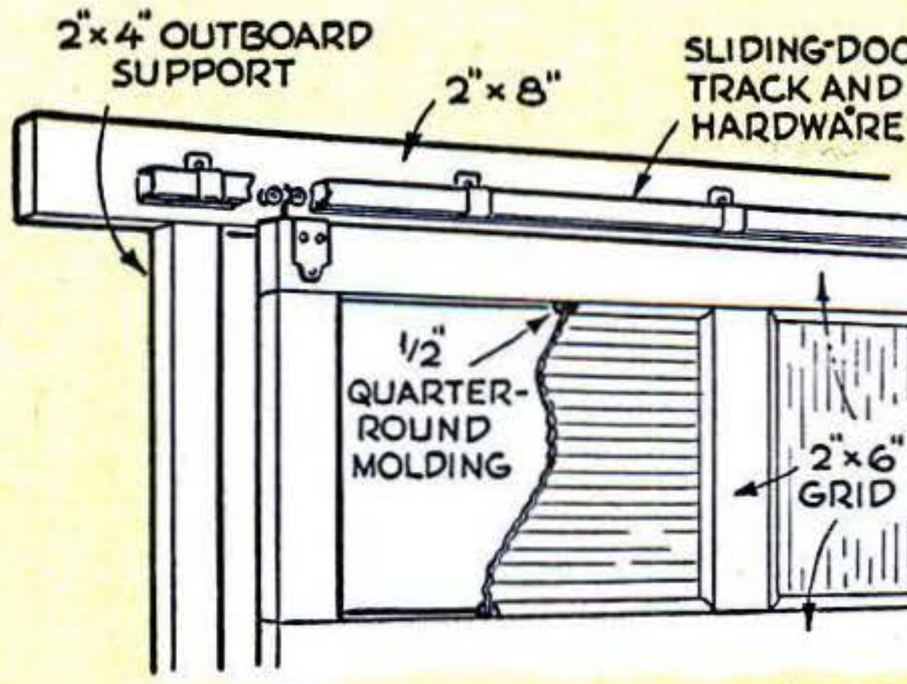


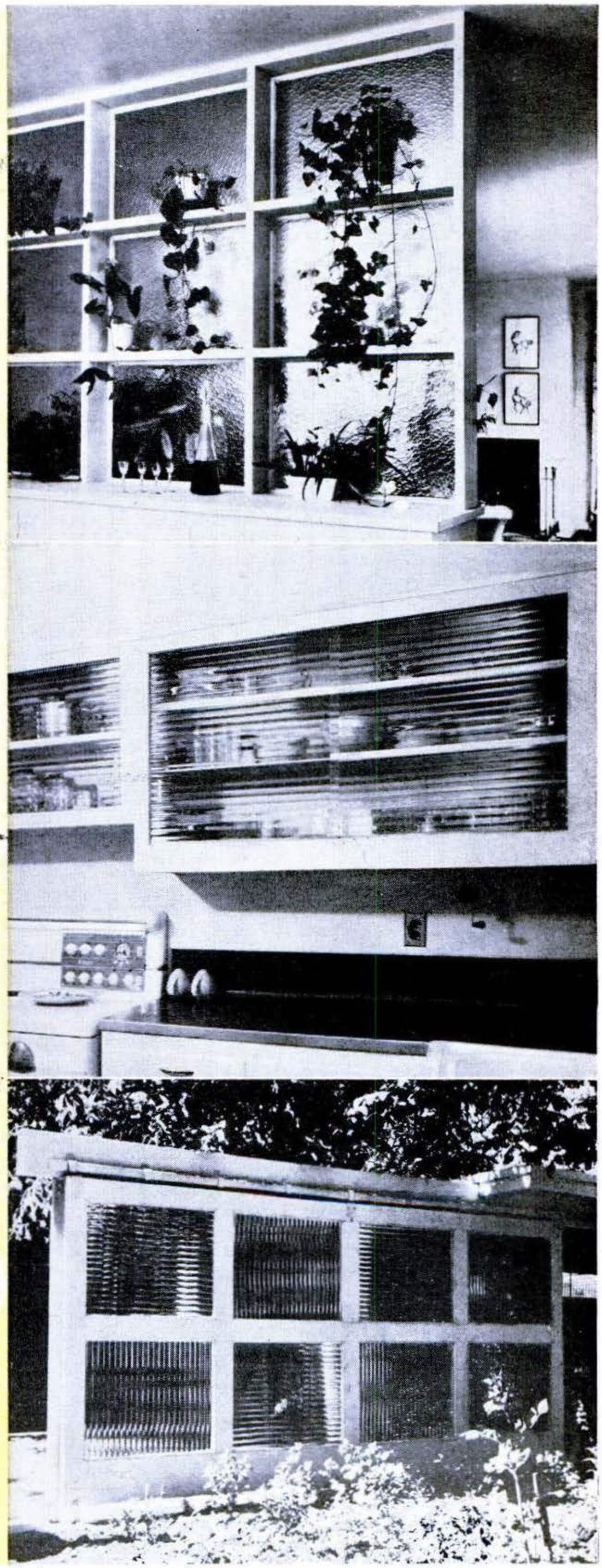
LOW-COST ROOM DIVIDER: Small panes of thin mottled glass set in a grid of one-by-three pine provide privacy without blocking off light. Inexpensive panes are held in place by strips of quarter-round molding nailed to each side of the grid.



SLIDING DOORS IN KITCHEN CABINETS: Ribbed glass panels set in wood or aluminum track let you see what's behind them while improving appearance. Instead of installing knobs, have the glazier grind smooth recesses for finger-tip sliding.



A SLIDING WALL can screen a patio or close off the garage. Build the wall frame of two-by-sixes and set ribbed glass as shown for a checkerboard effect. Hang the wall on standard overhead track bolted to a two-by-eight joist.



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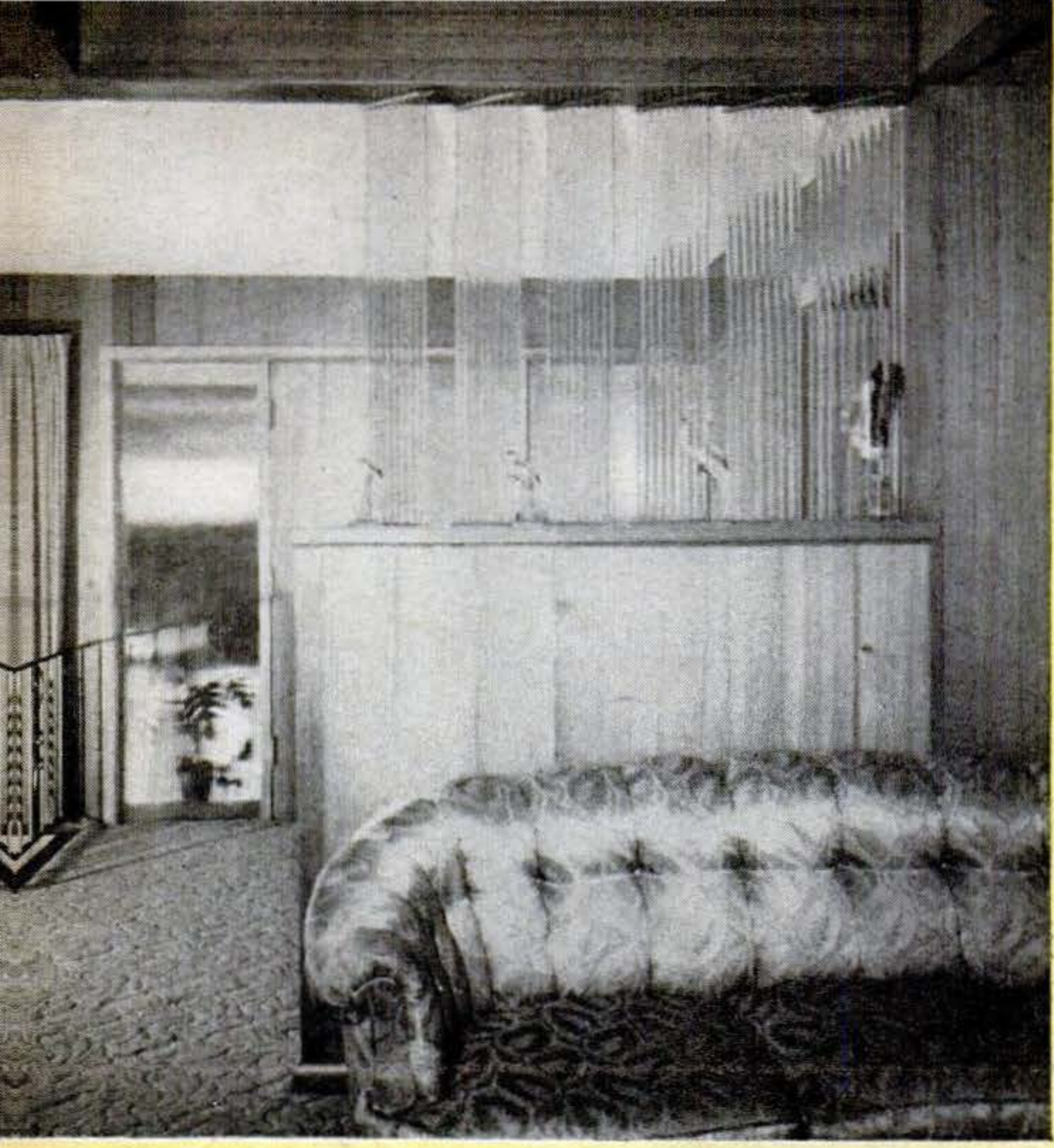
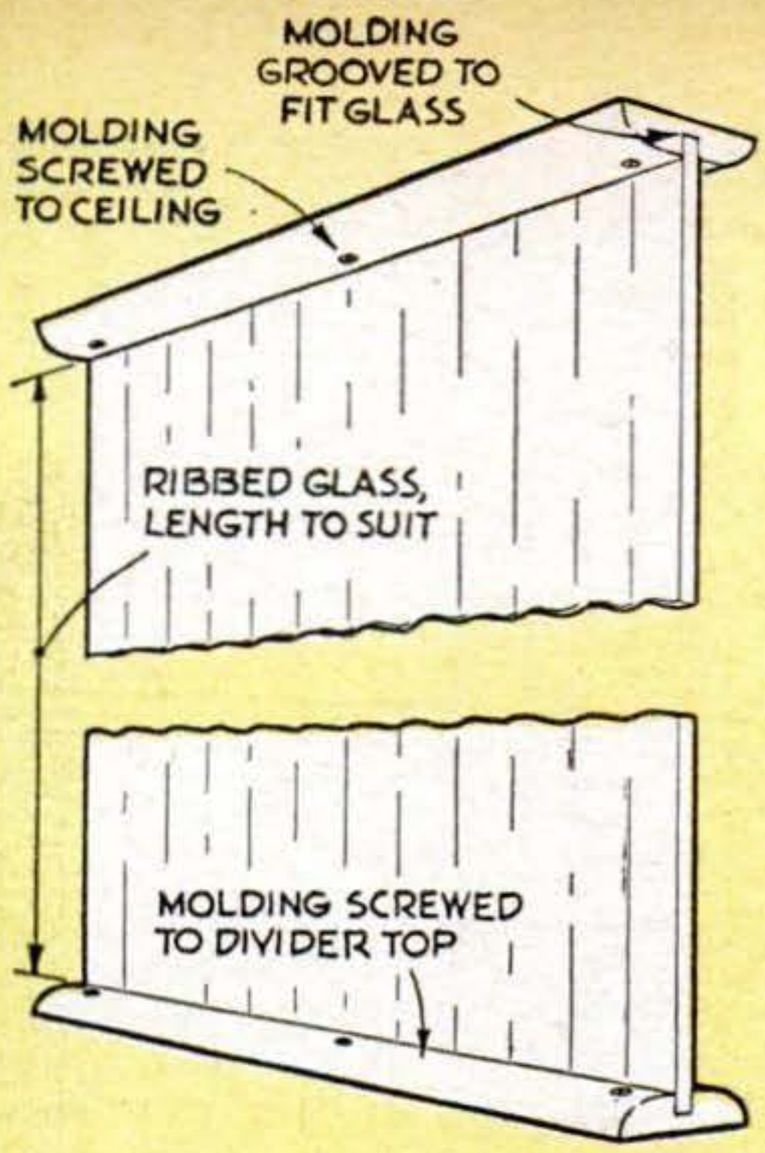
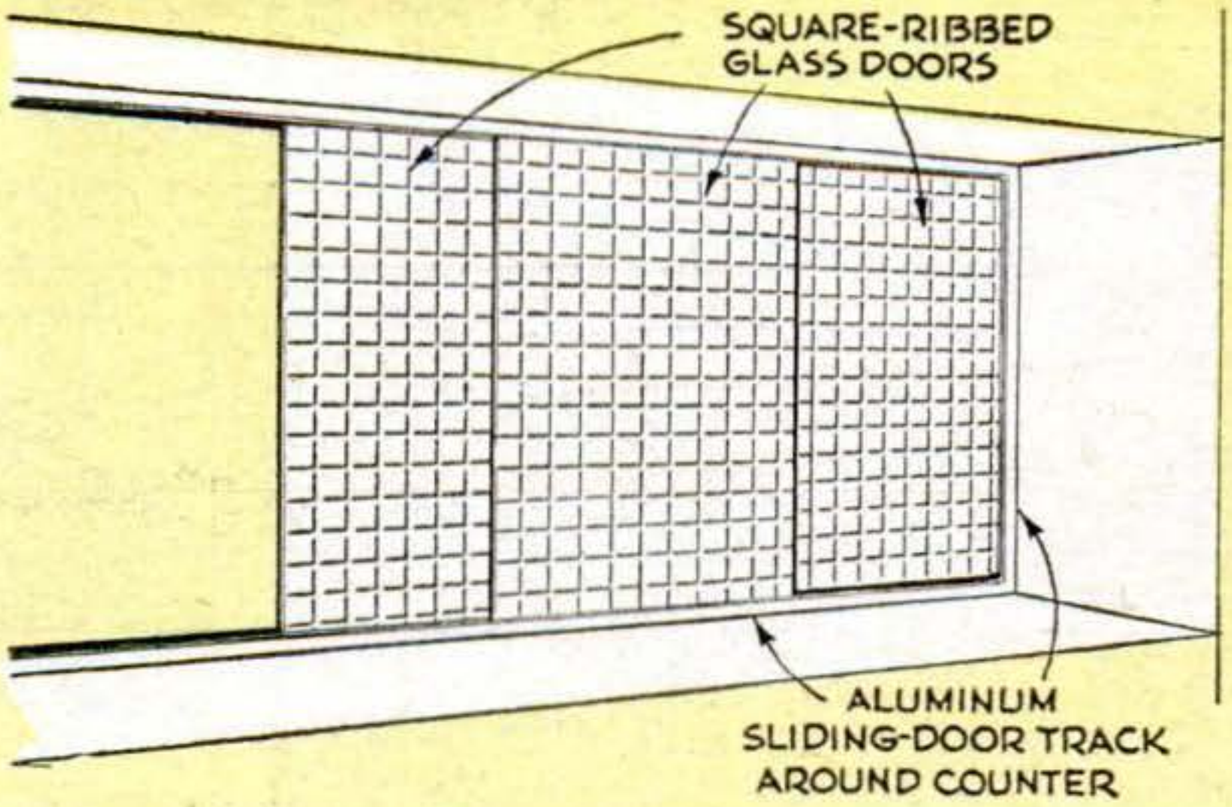




LOUVERED STRIPS divide a room, yet provide air and light. Strips of ribbed glass like these come in narrow widths requiring no edge finishing. Slide them into grooved wood holders screwed diagonally to the ceiling and to the surface or counter below.



CLOSE OFF A PASS-THROUGH between kitchen and dining room with sliding doors of patterned glass. Simply fasten aluminum track around the opening and order the glass ¼″ shorter. Figure width to allow doors to overlap 1″ when closed.

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Short Cuts and Tips

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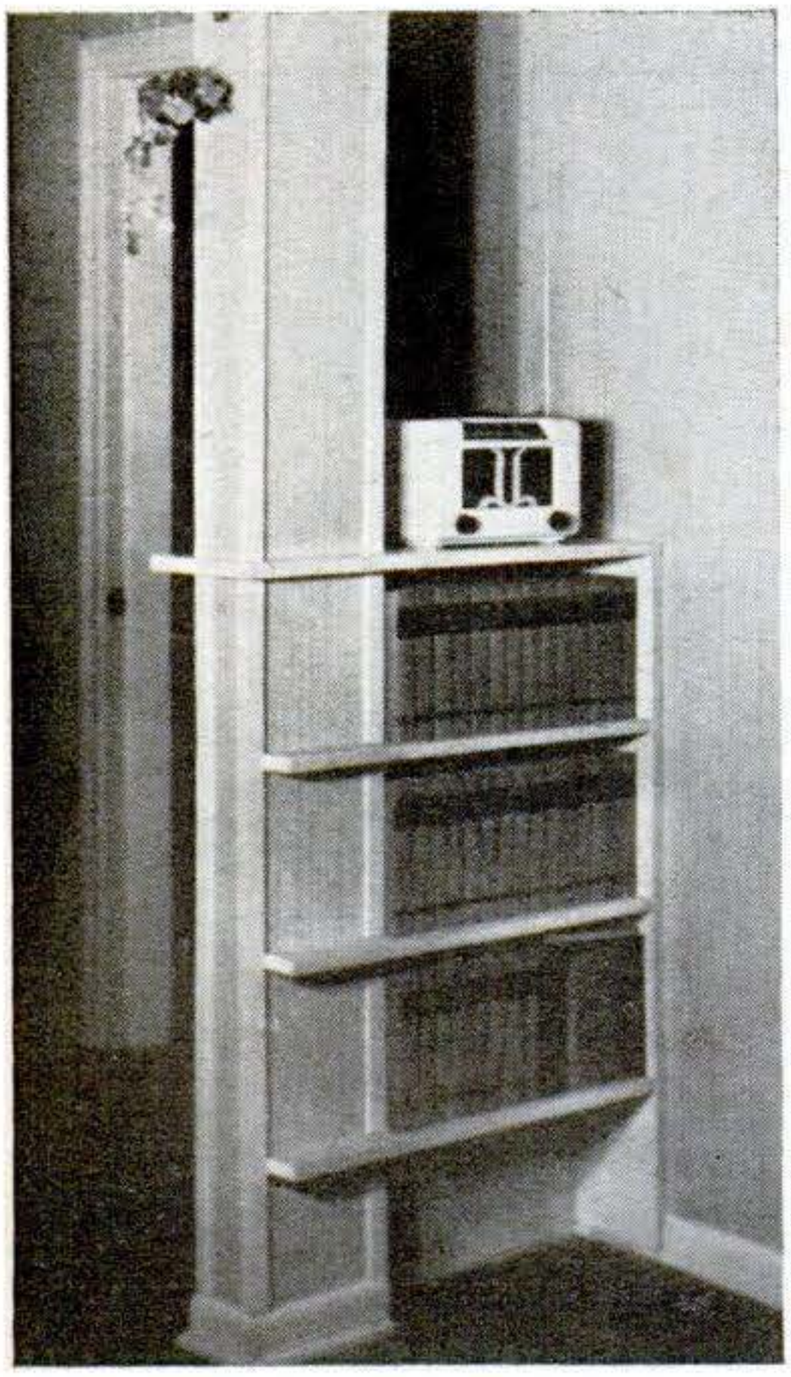
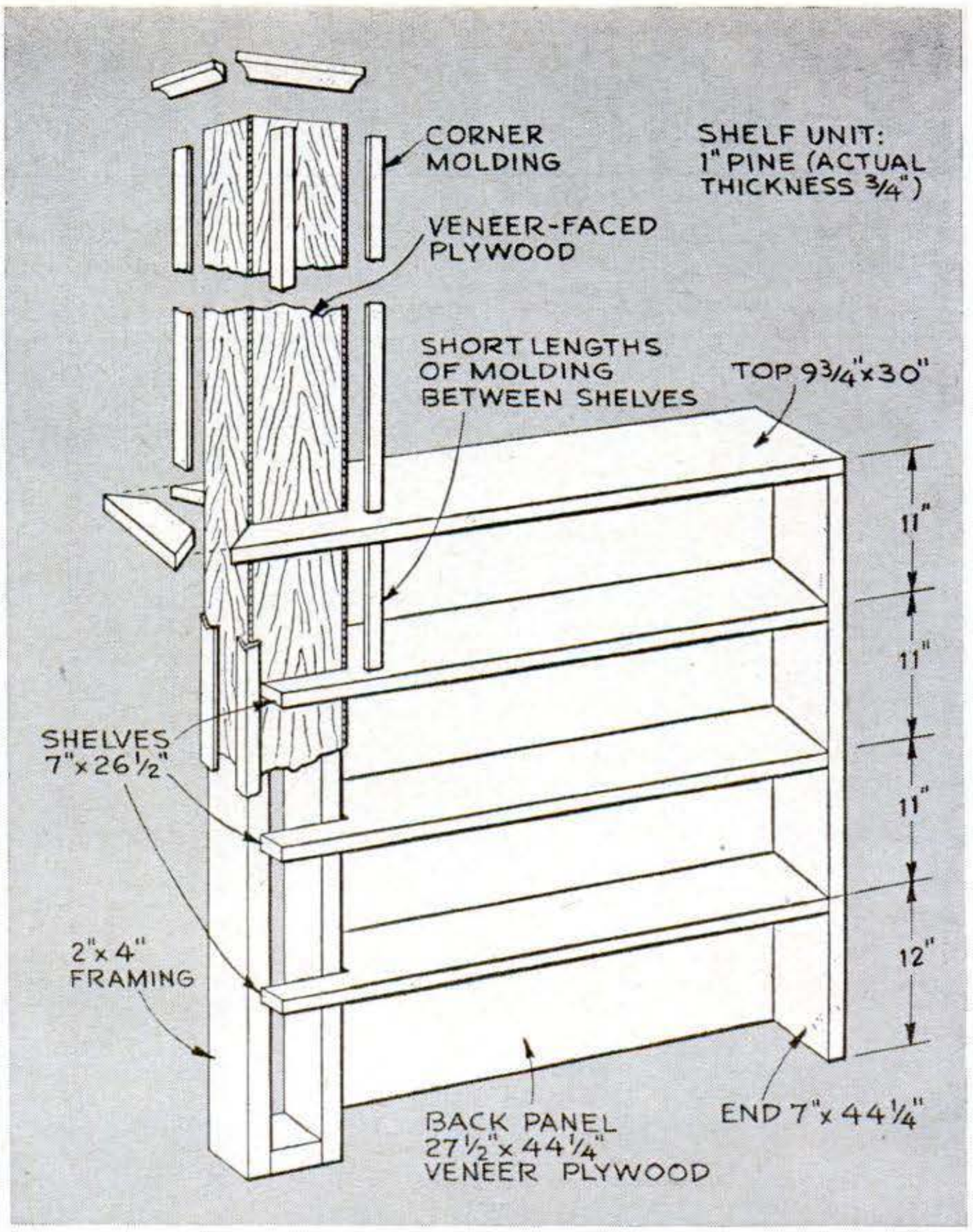
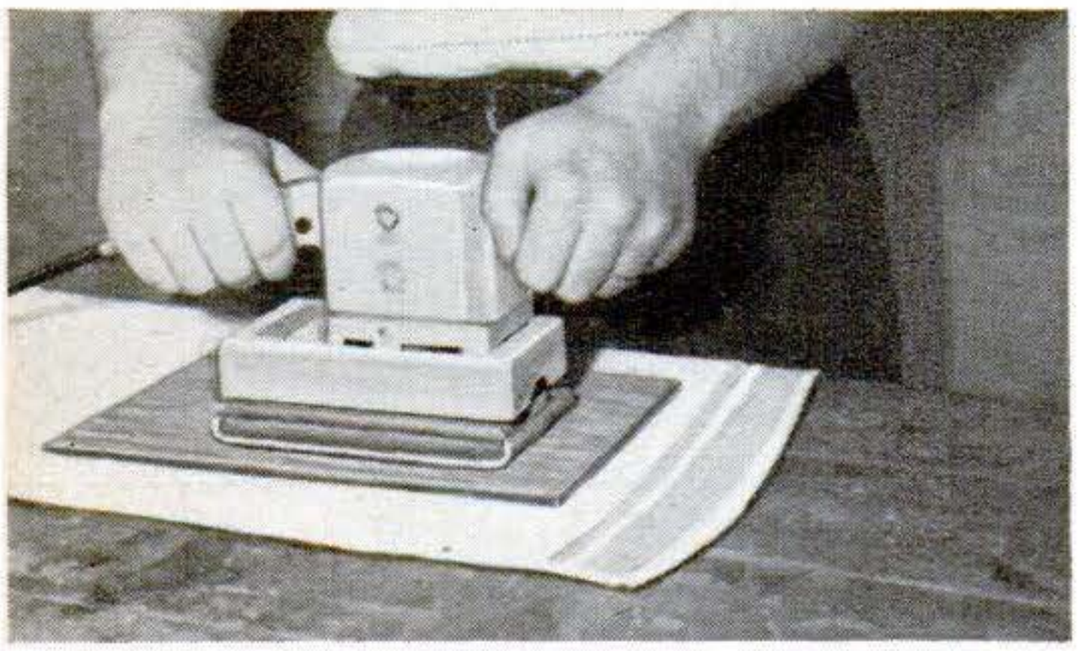




Column Shelves Divide Room

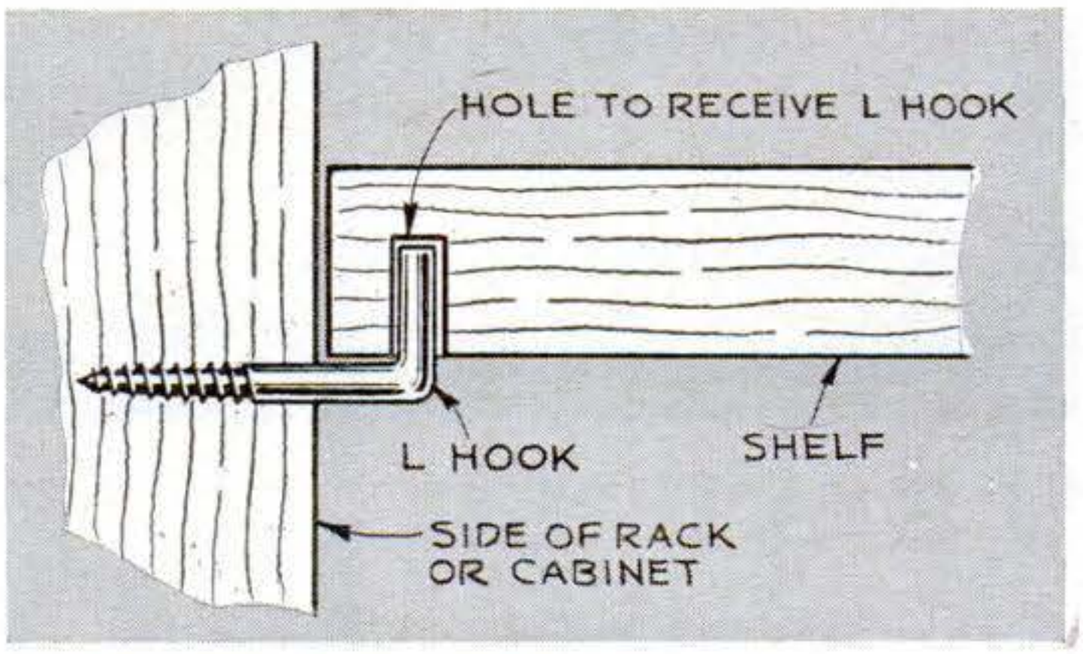
THIS room divider has a post made of two-by-fours nailed to floor and ceiling joists and covered with paneling.

The upper shelf projects beyond the back panel and is slotted to take the post. Others are nailed through the back panel and notched around the post. Mitered baseboards and ceiling trim, and lengths of corner molding, add the finishing touches.—*Victor H. Lamoy, Upper Jay, N. Y.*



Terry Cloth Prevents Slippage

TO KEEP a small board from skittering away when you use a portable sander on its surface, flatten a piece of terry cloth or an old towel on your workbench and lay the board on top. The cloth anchors the board, preventing slippage and eliminating the need for clumsy clamps.—*Ernest Reinmuller, Waukesha, Wis.*



L-Screw Shelf Supports

YOU can assemble a sturdy knock-down shelf unit without special hardware. Cut the shelves for a snug fit and hook them over L screws in the side members. Locate the screws—at least two at each end—and then drill holes in the shelf's underside to take the vertical part of each screw.—*J. Murdoch, Chicago.*

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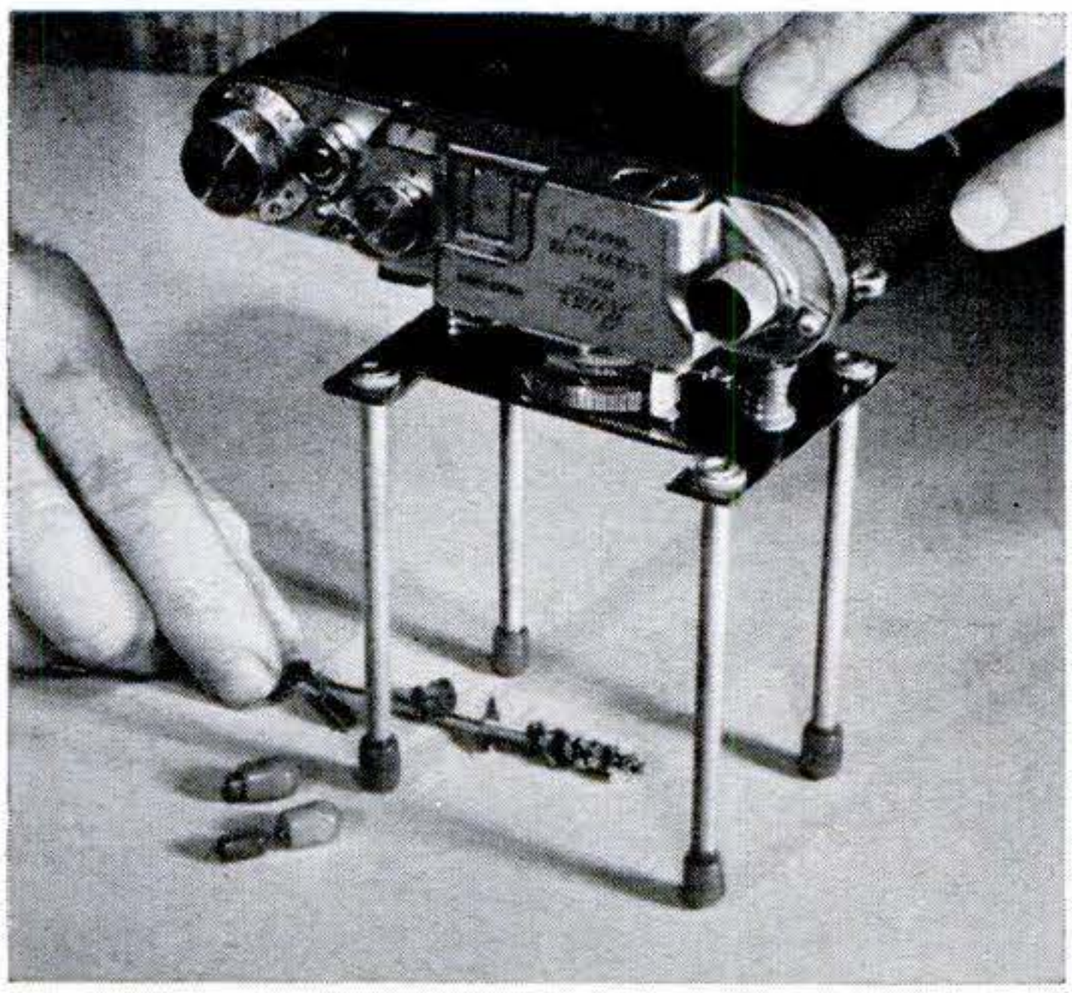
Rack from Looseleaf Binder

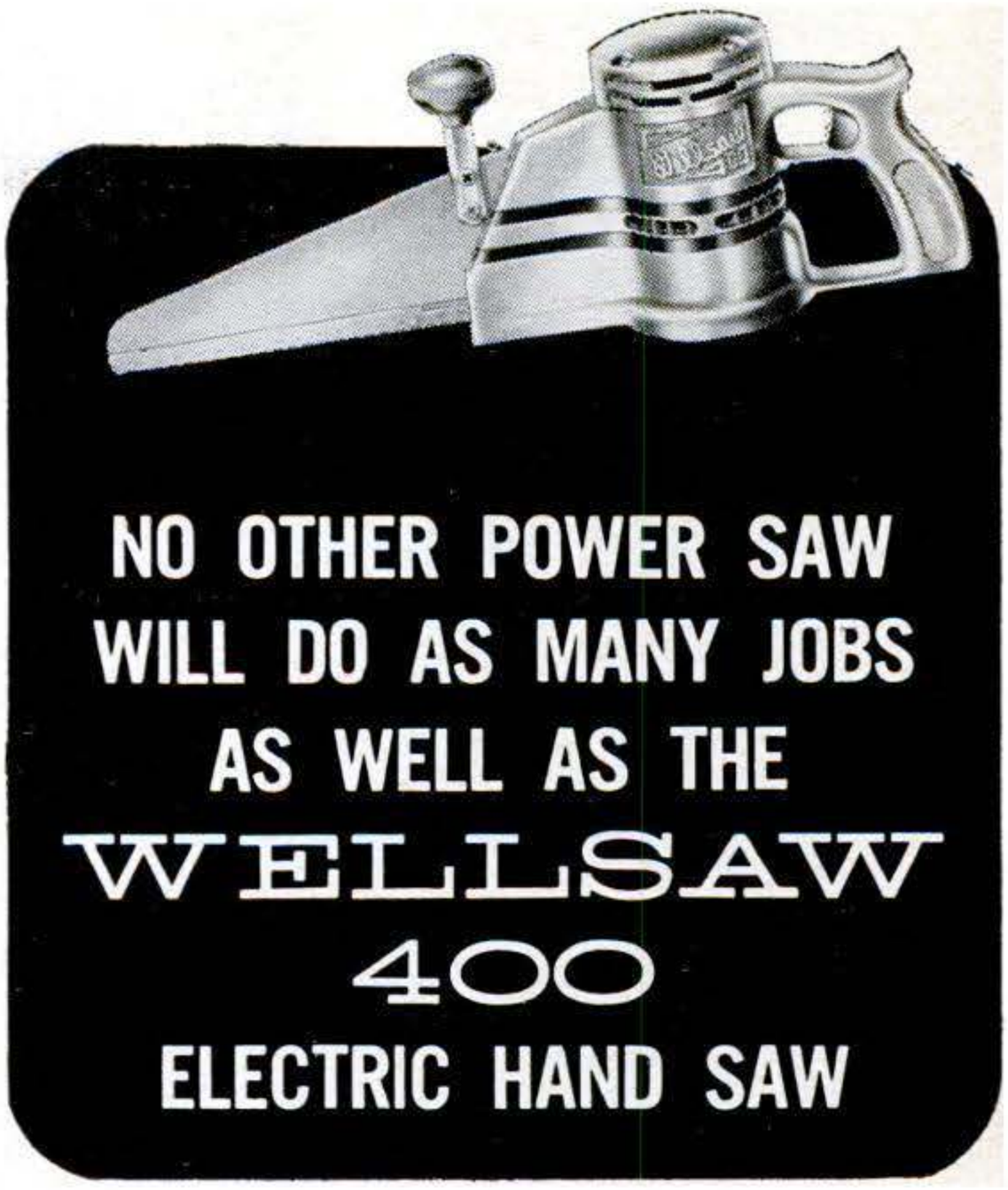
REMOVE the ring bracket from an old looseleaf binder, drill a hole in each end of it, and screw it to the wall. The binder rings won't open easily once they are snapped shut around an item you wish to hold. For example, friction tape placed in the binder bracket may be pulled right off the roll without opening the bracket. —*Kenneth A. Enochs, Glendale, Cal.*



Taking Close-Up Photos

A FIXED-DISTANCE copy attachment with an auxiliary copy lens for flat work can be used for taking close-up photos of small objects. Measure the thickness of the subject and raise the attachment legs an equivalent amount to focus the lens on the subject's top surface. The plastic tips used on 1/8" and 1/4" perforated-board hangers will add as much as 7/16" to the leg length. You can slip the 1/4" tips over the 1/8" tips and make fine adjustments by sliding them on the legs.—*Walter E. Burton, Akron, Ohio.*

For new construction or remodeling . . .



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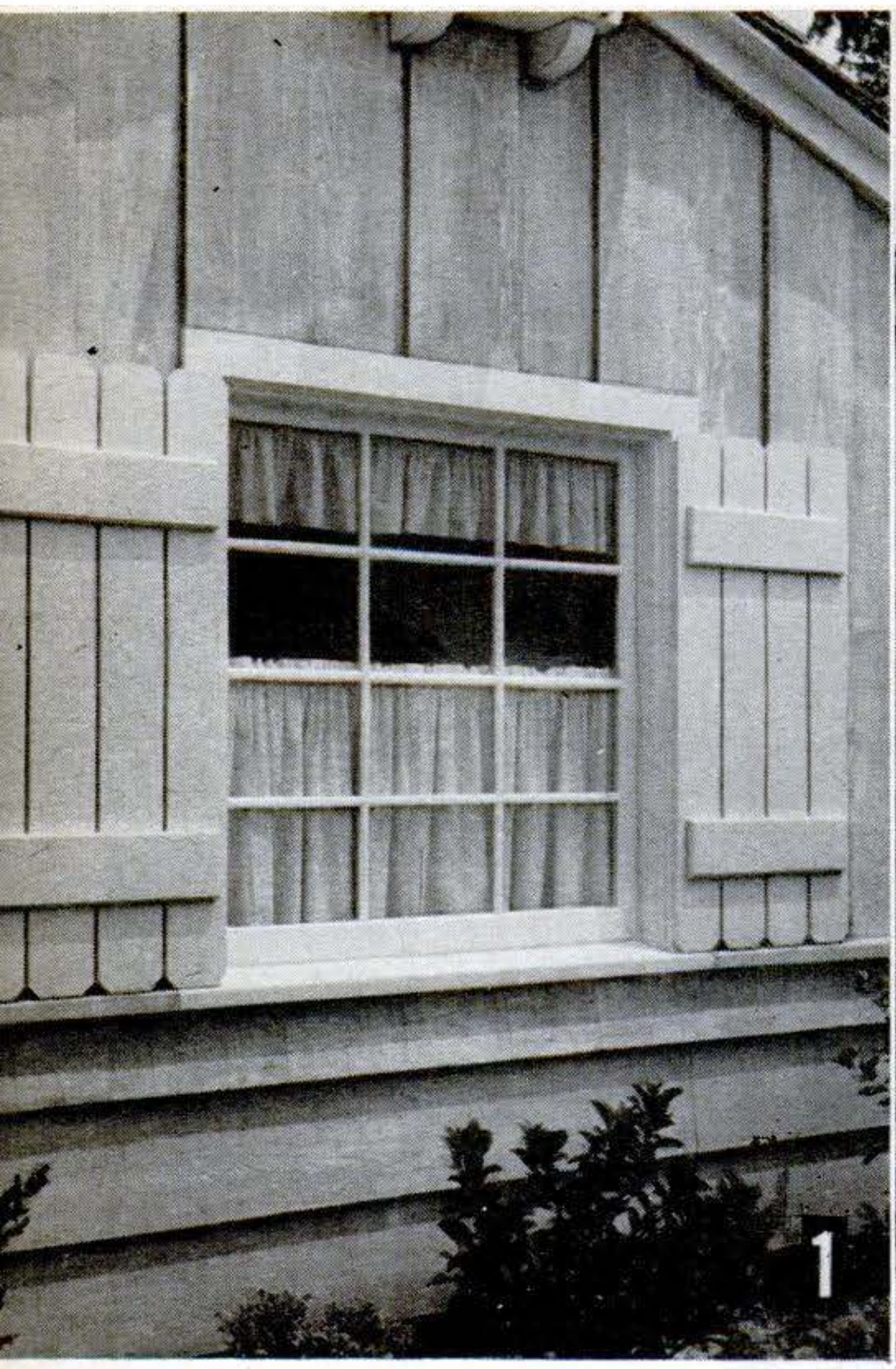

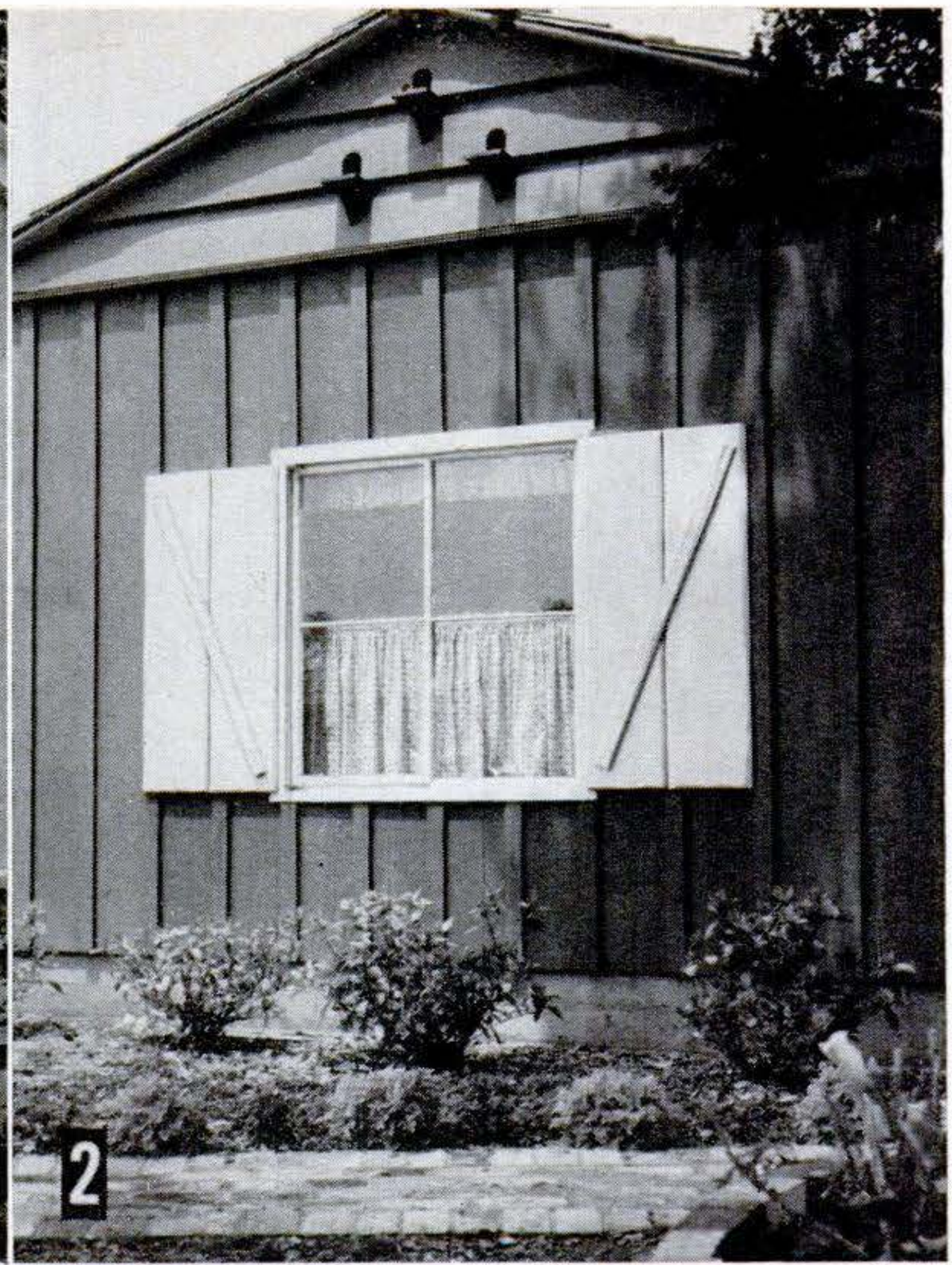

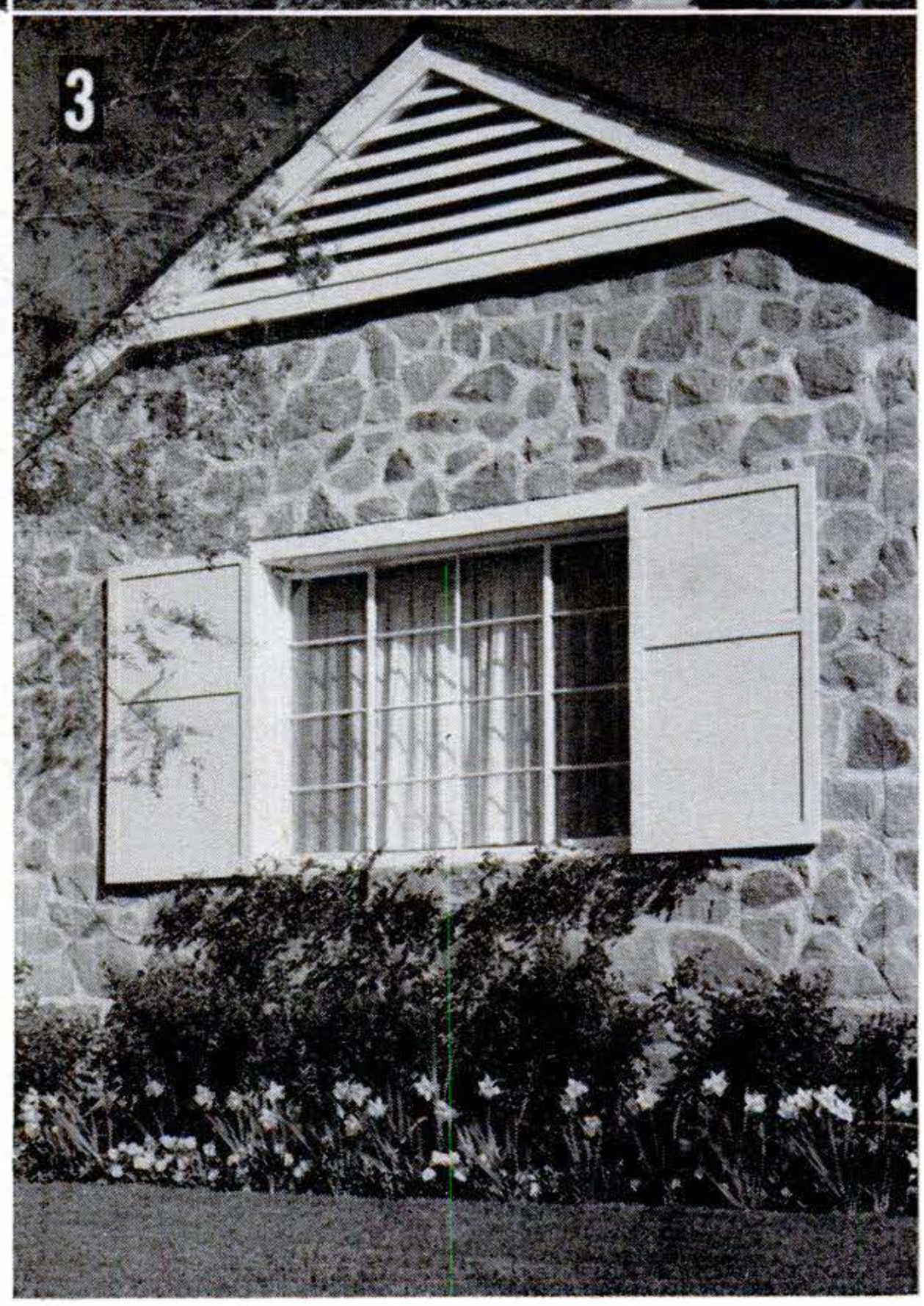

Simple Shutters

YOUR home can have shutters at little expense. Two of the three homemades shown here require only common one-inch lumber. The vertical pieces in photo 1 are held together by beveled battens screwed in place. In photo 2, furring strips nailed diagonally keep the assembly together. The third example consists of a hardboard panel on a frame of one-by-twos.

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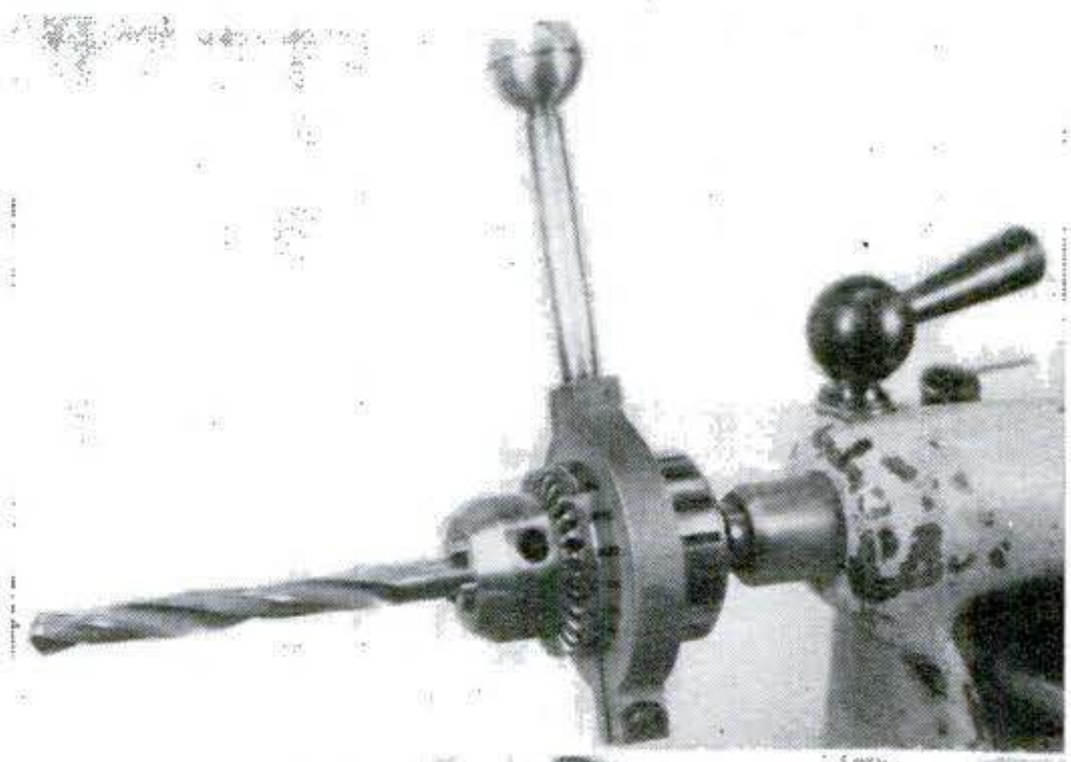
Short Cuts and Tips

FROM PS READERS

Reversing Dull Blade for Faster Cuts

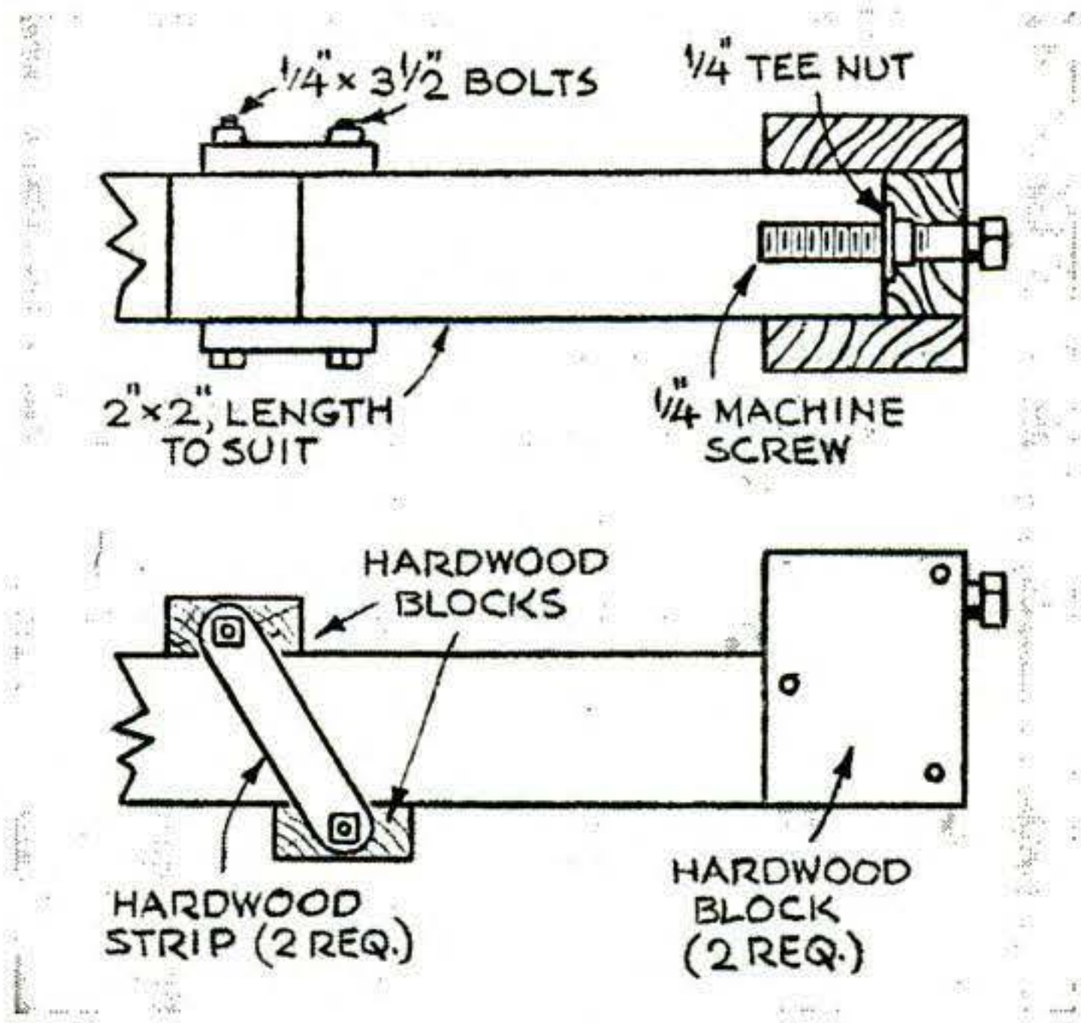
I HAD to cut out sections of baseboard molding with a handsaw whose tip teeth were dull from wallboard work. I removed the handle, reversed the blade, and used the sharp teeth at the handle end to make a "blind" cut across the molding. To protect my hands, I wrapped a rag around what would normally be the forward end of the blade.—*L. E. Owen, Portsmouth, Ohio.*

▶▶▶KINKS in light-gauge uninsulated wire can be straightened by bending the wire around a pipe and pulling back and forth. —*John Michaels, Mansfield, Ohio.*



Quick-Change Chuck Lever

QUICK drill changes can be made on an engine lathe with the help of this lever. The assembly consists of a split collar, bored to fit the sleeve of the chuck; a lever handle, with ball end, that screws into the collar; and a cap screw to bind the collar. A chuck key isn't needed—a sharp rap on the lever will unlock the chuck and spin it open.—*Howard S. Garth, Oklahoma City, Okla.*



Homemade Bar Clamp

FEW shops have all the bar clamps that are needed. Here is one I constructed recently from materials found in most home workshops. In use, the square-head machine bolt is tightened with a wrench. A pad of scrap wood under the screw end prevents marring the work. The hardwood side pieces could be replaced with metal for a longer-lasting clamp.—*Joseph C. Testen, Canoga Park, Cal.*

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Short Cuts and Tips

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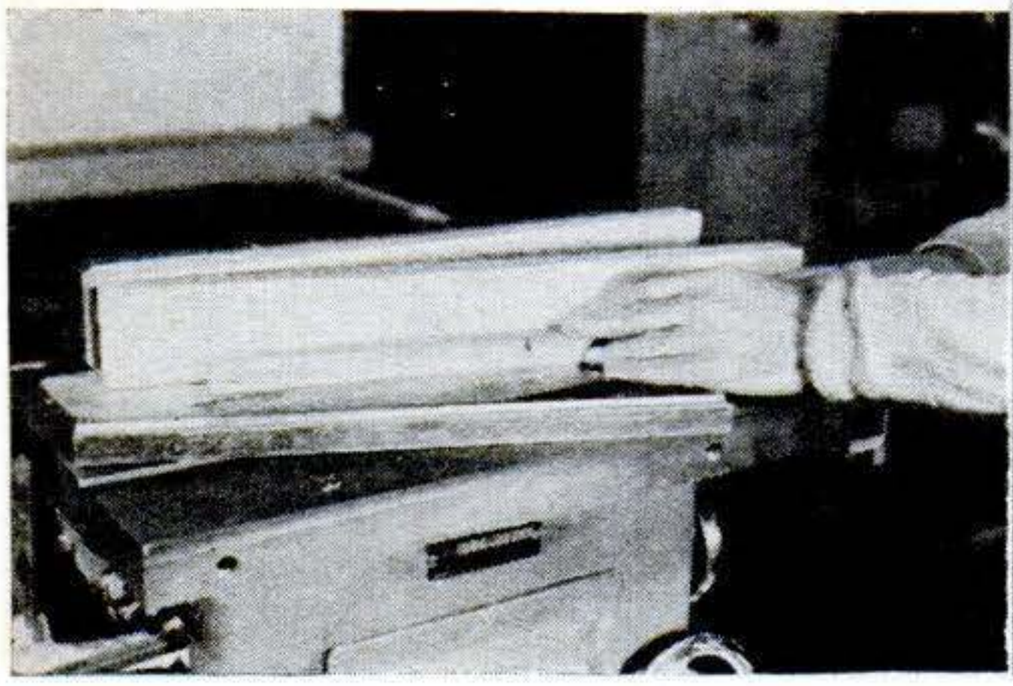
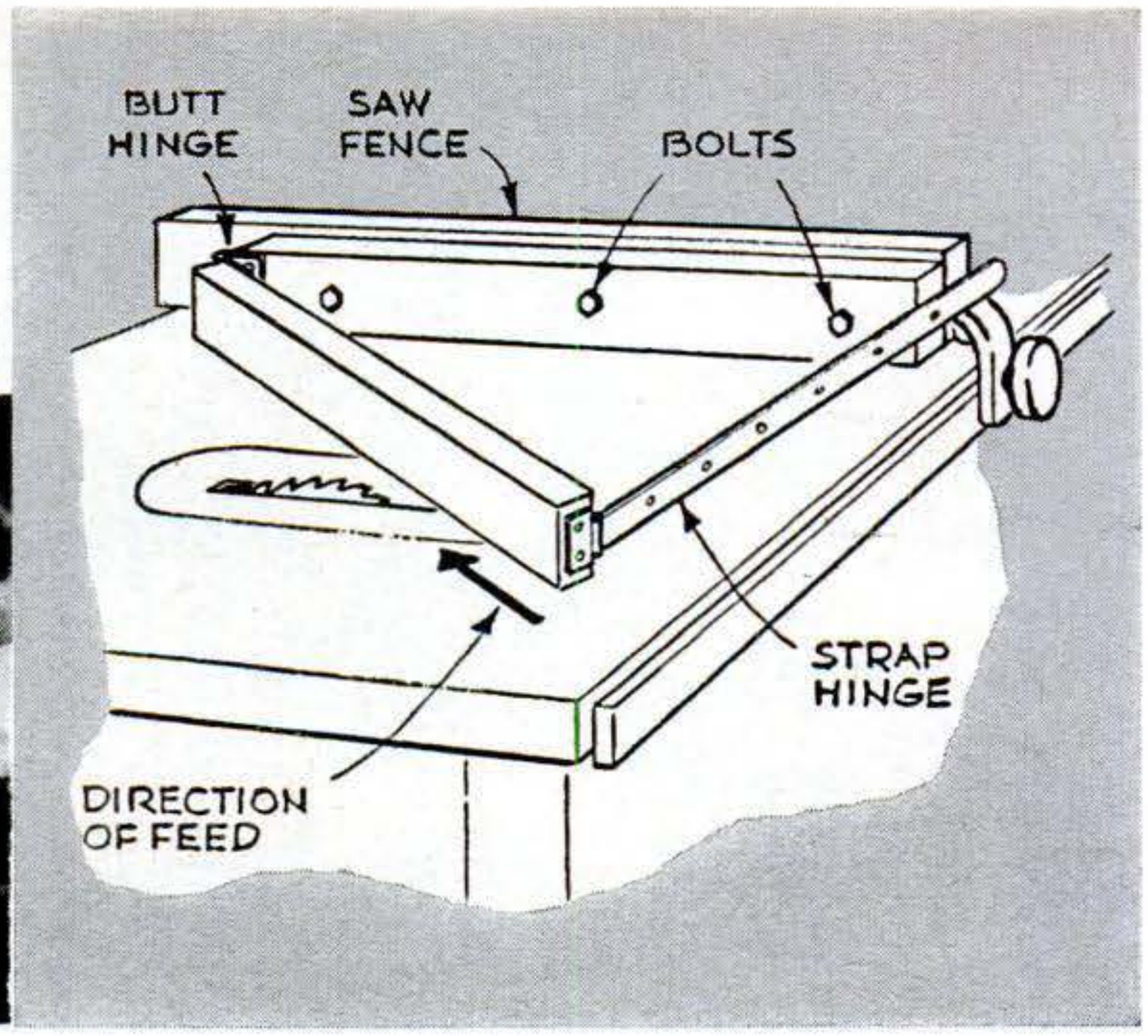


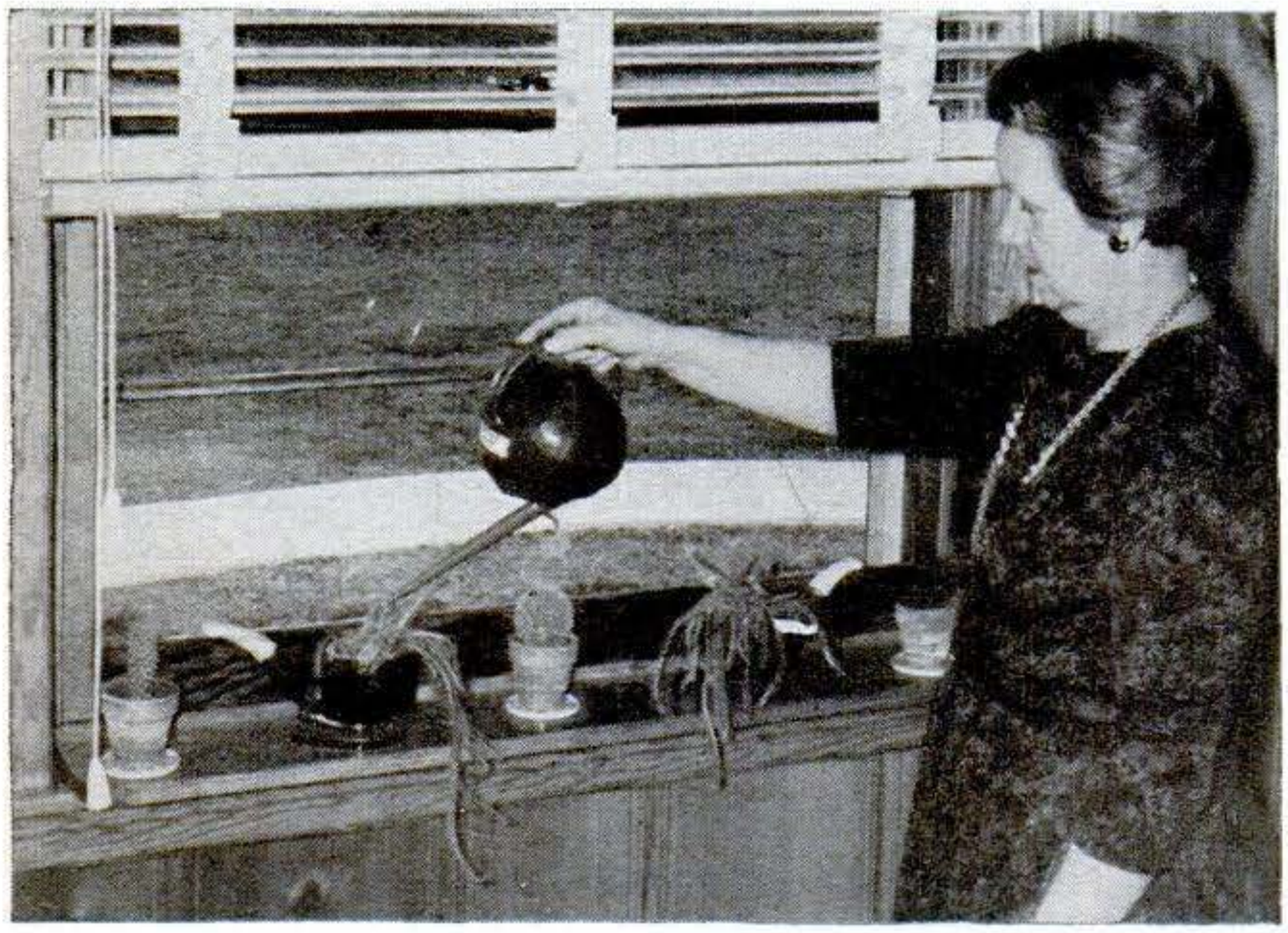


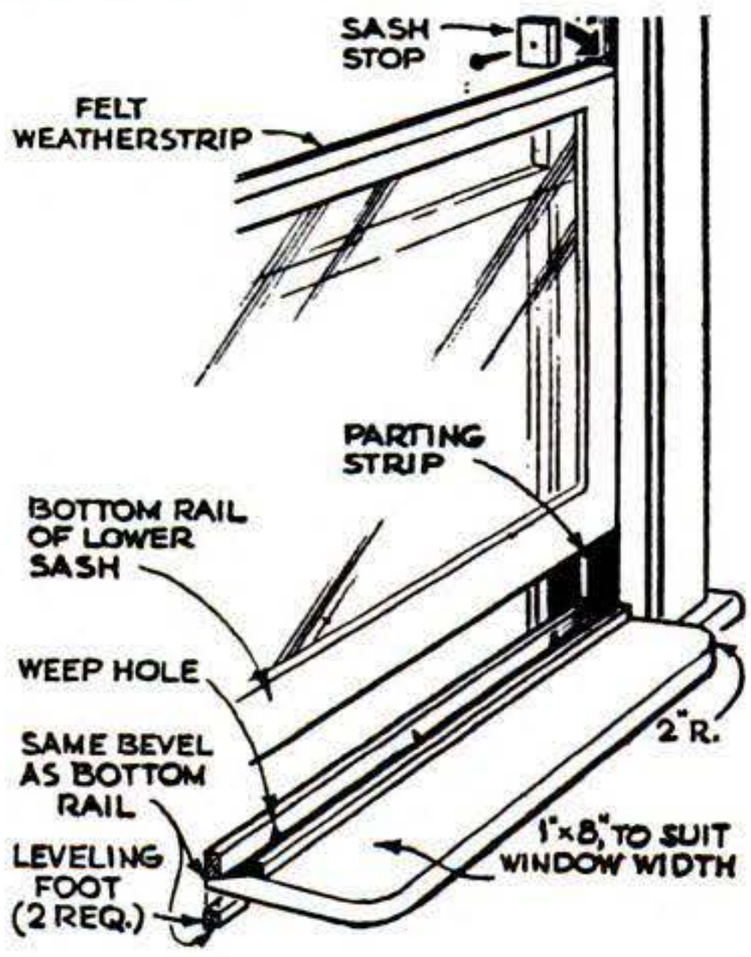
Shaping Jig for a Bench Saw

WITH this jig you can use a table saw as a shaper for cutting concave grooves and flutes, or for making cove molding. The stock is fed diagonally across the teeth of the blade instead of directly into them. Several passes may be required since only a depth equal to the height of the teeth can be cut each time. The jig is an adjustable fence hinged to an anchor block which is bolted to the regular fence. The two jig members are held at the desired angle with a strap hinge or iron bar drilled to permit adjustment. —*Michael Ligocki, Gary, Ind.*

▶▶▶LEAVE the margin on when you buy a sheet of stamps. Then, if you want to send one stamp or several in a letter, moisten the margin only and attach it to the paper.—*C. C. Briggs, Reno, Nev.*

▶▶▶GLUE a rubber stair tread on the wooden seat of your youngster's swing. It will prevent slivers and slipping—and dry out much faster after a rain, too. —*M. Krucker, Davenport, Iowa.*





Sun Shelf for Flowerpots

THIS plant shelf is movable and won't mar the window frame; it's held in place by the lower sash. A bevel matching that on the bottom of the sash rail is cut along the rear of the shelf and a channel is formed with wood strips. The lower edge of the back strip is beveled and notched for drainage. The shelf feet and sash stops are 4″ lengths of one-by-two. The feet are beveled to conform to the tilt of the sill. The sash stops are secured in the window channel above the bottom sash, to lock it tightly against the shelf. —*C. D. Neal, Carbondale, Ill.*

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New way to heat with oil

Here is a remarkable new heating development by Iron Fireman, called CUSTOM Mark II VoluMetric Combustion — which eliminates smoke and soot — uses much less fuel — needs no chimney draft — greatly improves home comfort by smoothing out uneven heating.

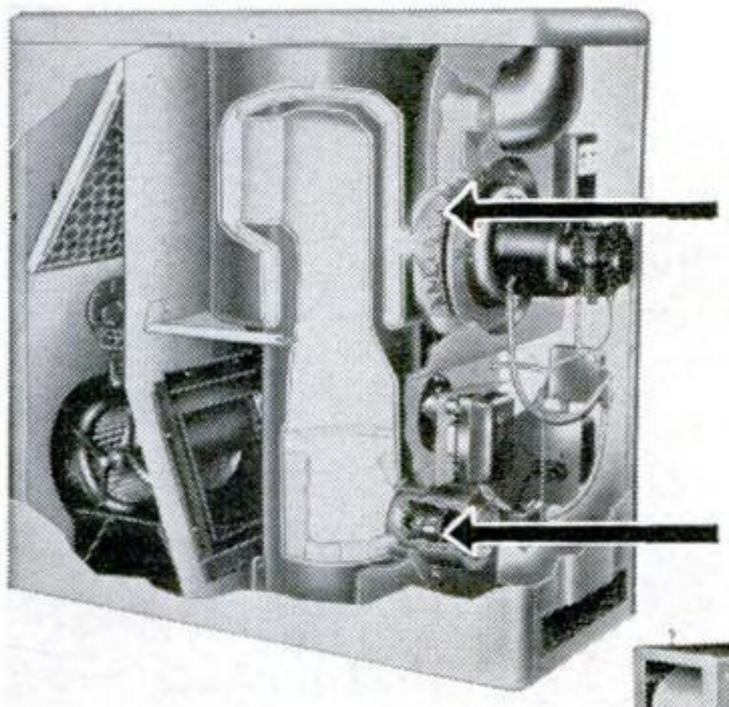
Smoke and soot are banished from your heating system and your home by CUSTOM Mark II firing, and with them go about 95% of your service costs (caused by carboned oil nozzles, dirty electrodes, and soot blanketed heating surfaces). New *sealed* combustion chamber stops "standby loss"—the loss of heat up the chimney after the burner turns off. This, with 100% combustion of the fuel and elimination of smoke and soot, results in amazing fuel savings.

Big fuel savings, plus wonderful comfort

CUSTOM Mark II VoluMetric Combustion has been under development for 10 years and is now in use in thousands of homes and buildings. Users report fuel cost savings ranging from 40% and higher, down to 18%. An owner reports from Rhinelander, Wisconsin: Cost of heating a six room house during previous heating season, $244.50. Cost last season, with a CUSTOM Mark II furnace, $136.39, a saving of $108.11, or 44%. Users are enthusiastic about the top comfort they enjoy. *Mail coupon for further information, sent free.*

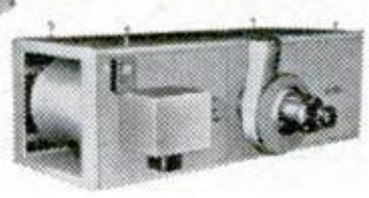
Iron Fireman CUSTOM Mark II OIL FURNACES AND BOILERS

with VoluMetric Combustion



With VoluMetric Combustion, all the correct conditions needed for total combustion are created **within the furnace** without smoke or soot. A furnace or boiler with this advanced firing system **needs no chimney** . . . simply an exhaust vent. With VoluMetric Combustion both oil and air are metered with precision, as in a carburetor, and mixed in the exact ratio required to produce a smokeless flame. Combustion is clean **from the very instant of ignition** each time the fire starts, and **stays clean.** This is accomplished by the Combustion Flow fan (top arrow) and the unique fuel and air injector (bottom arrow).

Unique horizontal furnace for commercial and home use



Since it needs no chimney . . . merely a small exhaust pipe . . . this unit space heater can be used in any commercial building, including: service stations and garages, stores, factories, bowling alleys, warehouses. Can be suspended from the ceiling and a small vent pipe put through the ceiling or wall. Ideal for many residential heating applications.

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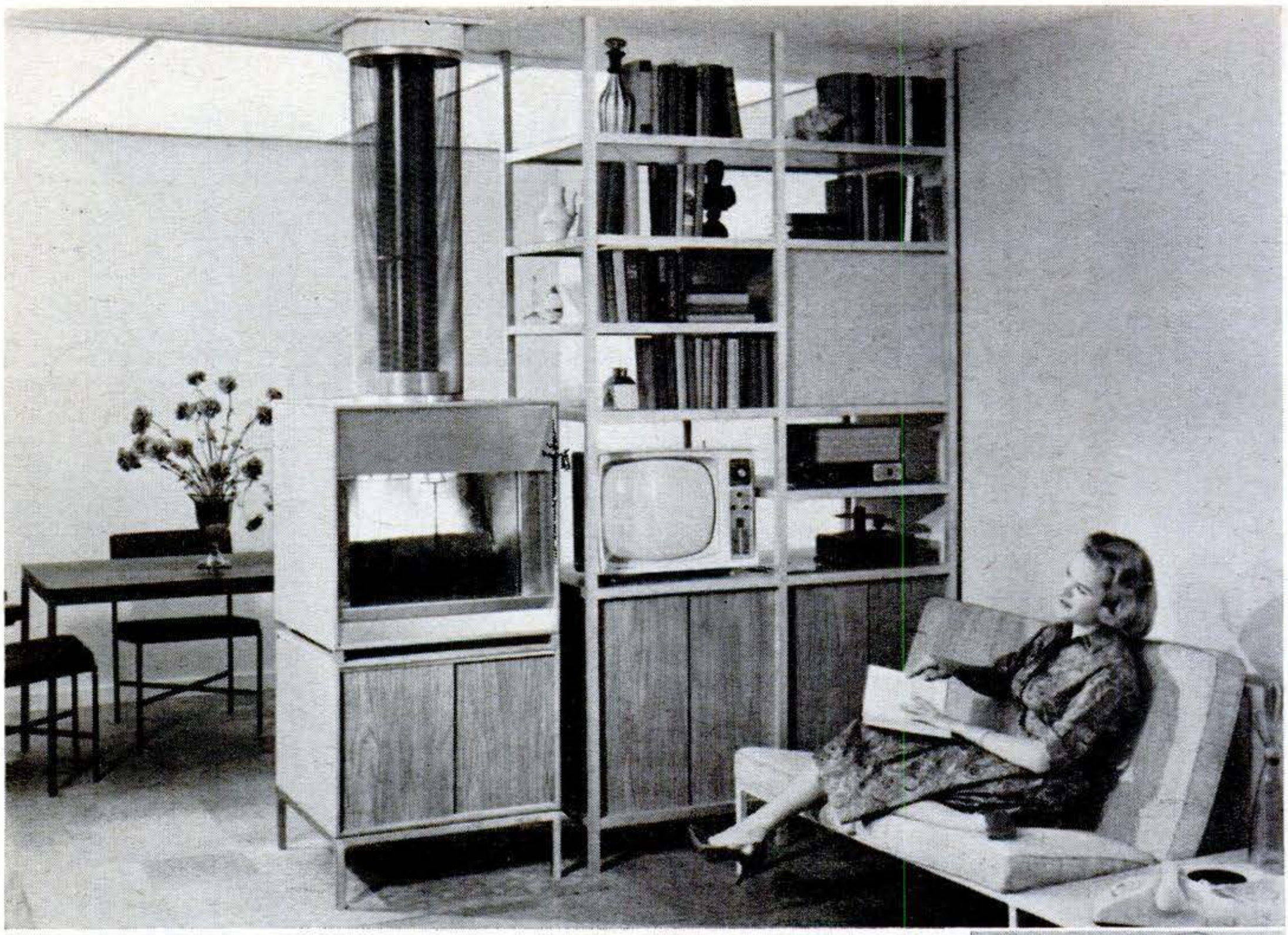
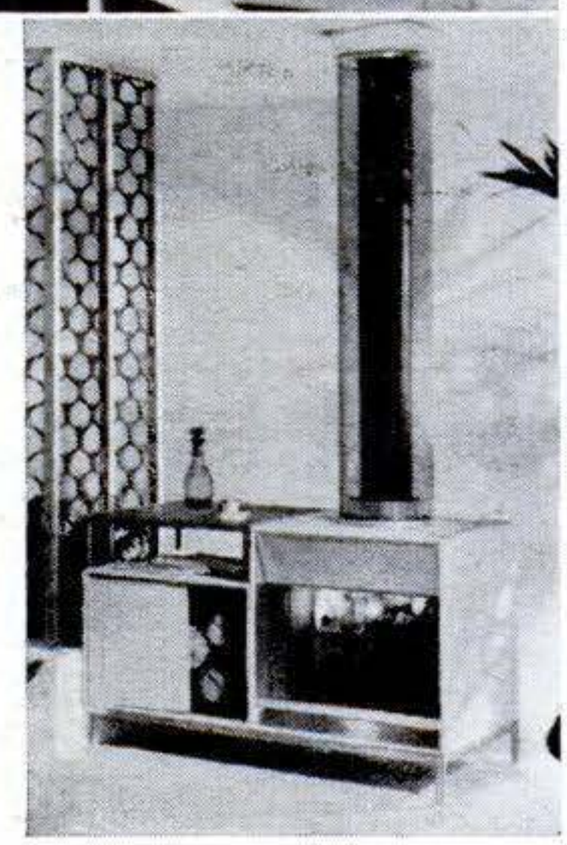


New Fireplace Matches the Cabinets



YOU have to look closely at the scene above to pick out the fireplace from the matching cabinets. It's a new Uni-bilt model offered by Vega Industries, Inc., of Syracuse, N. Y. The fireplace can be bought alone or with matching woodbox and cherry table-top sections, both seen in the photo at right. Above, the woodbox has been placed under the fireplace. The firebox and woodbox are factory primed and can be painted any desired color—or matching cabinets can be built. You install the fireplace by placing the sections in the desired arrangement, installing liners in the firebox, and running a stovepipe to the chimney. An expanded-aluminum sleeve is furnished to surround the stovepipe.

Home-Music System Fits into the Wall

YOU don't have the problem of space-stealing cabinets with a new stereo-intercom system developed by NuTone. Amplifier, tuner, record player, tape deck, and speakers are recessed into the walls between standard 4" studding. The master controls can send AM or FM radio, hi-fi record music, cartridge tape recordings, or intercom anywhere. With extra wall speakers, stereo can be heard in any room.

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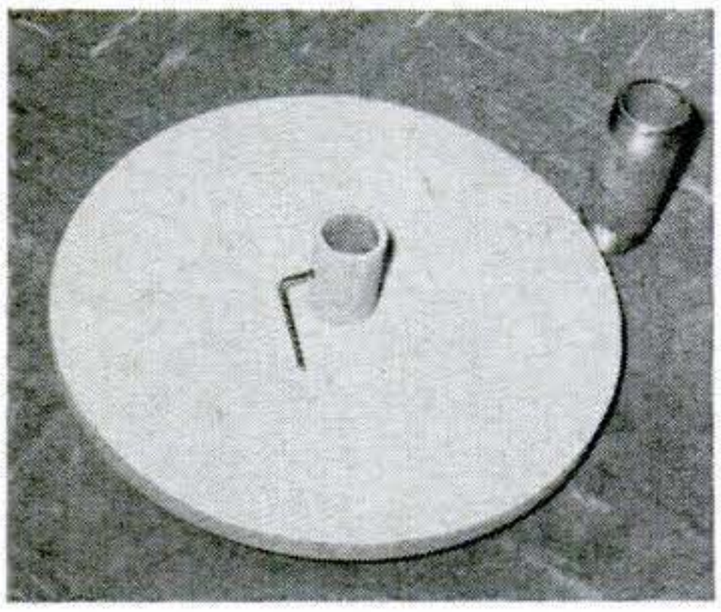
Short Cuts and Tips

FROM PS READERS

How to Make a Pole-Lamp Table

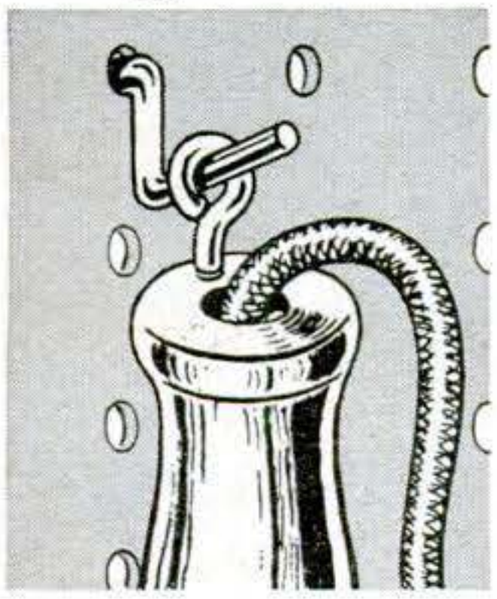
A WOODEN disk slipped on a floor-to-ceiling pole lamp makes an adjustable smoking or reading table. The center hole is bored slightly smaller than the outside diameter of a pipe nipple that will fit over the pole. The threads on one end are cut off; those on the other are turned into the hole. A setscrew in the nipple locks the unit to the lamp pole.—*William G. Waggoner, Sacramento, Calif.*



▶▶▶EVER wish you had an X-ray of your home to locate hidden wires and pipes? By photographing the open walls of his new house after the electricians and plumbers had gone, a friend was able to find several outlets that were later walled over by accident. He's keeping the labeled photos as a guide for future improvements and repairs.—*Imogene Fey, NYC.*

▶▶▶I STRAINED my left arm before I could apply the stucco color coat to a plastering job, so I tried a one-hand method. I mixed the color coat to the consistency of oil paint and applied it with an 8″ fiber-bristled whitewash brush. I finished the job in one-fourth the time troweling takes and got a more professional look. —*Phillip J. Shuler, Acton, Calif.*

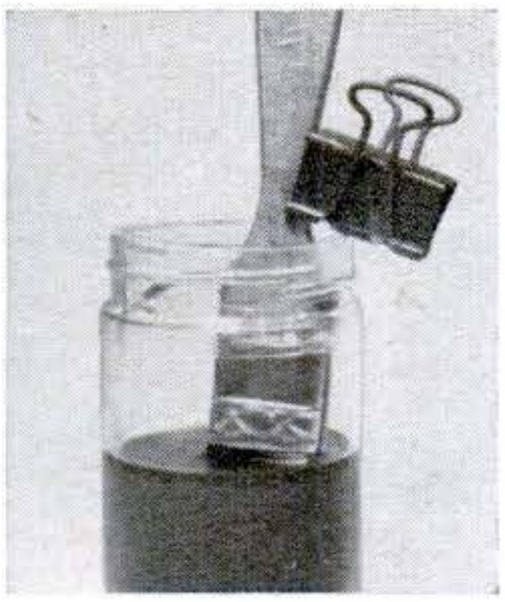
Hanger for Soldering Iron



DRIVE a small screw-eye into the end of your electric soldering iron so that you can hang it neatly out of harm's way. It won't interfere with the tool's function.—*J. E. Palmer, Philadelphia.*

Clip Suspends Paintbrush

CLAMP a spring-type paper clip on the handle of a small paintbrush and hook it over the lip of a can or jar to suspend the bristles in solvent after painting. —*Robert Hertzberg, Douglaston, N. Y.*



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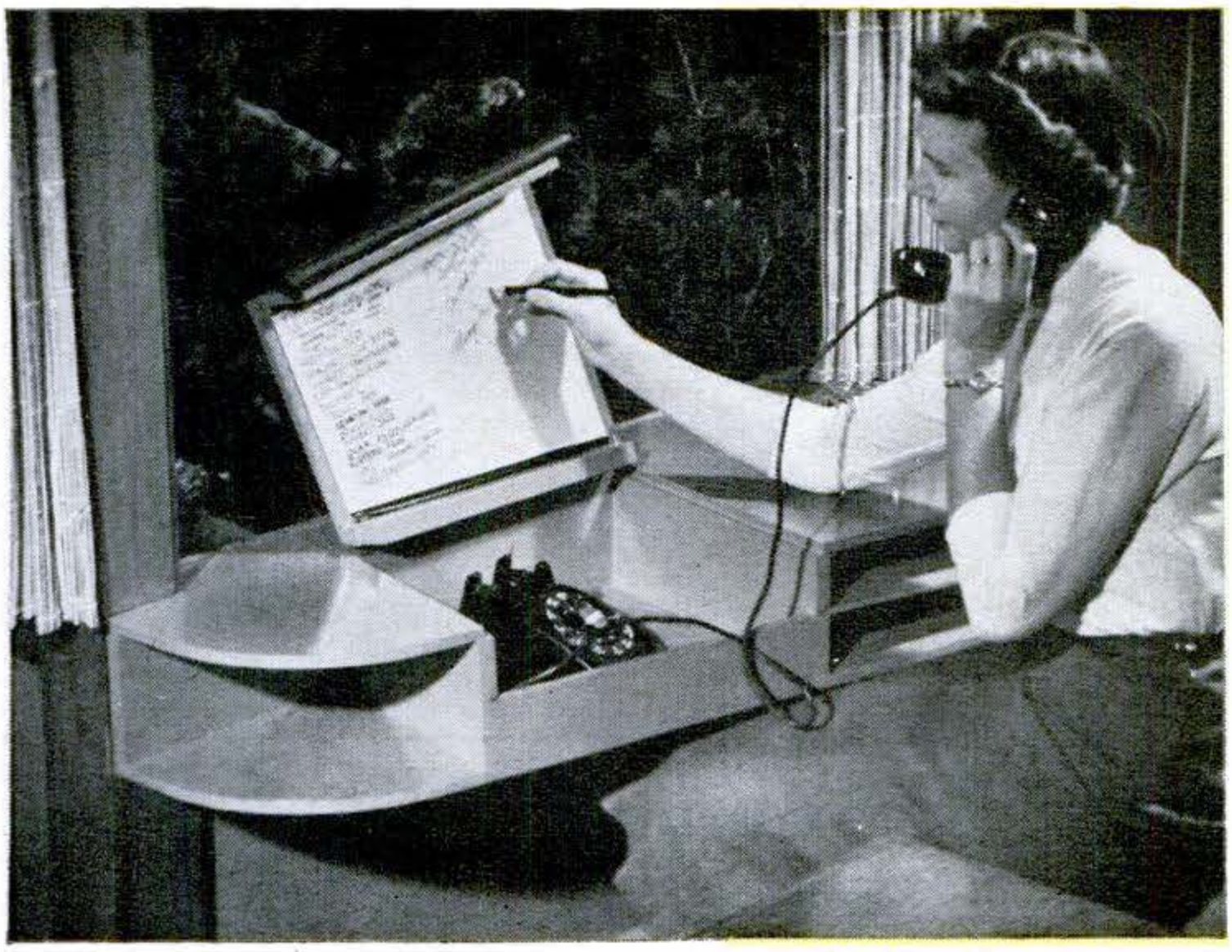


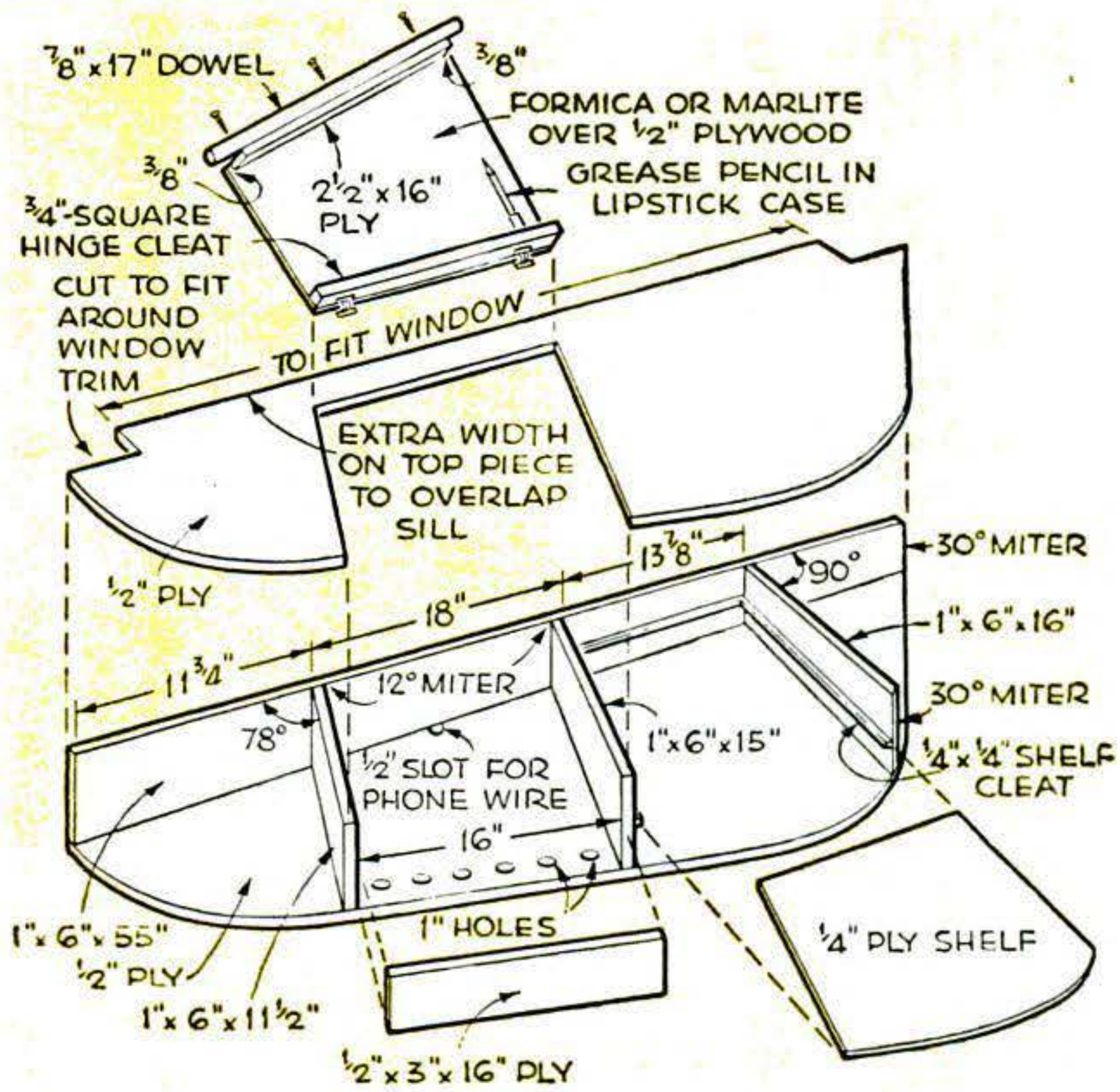
Built-In Desk for the Phone

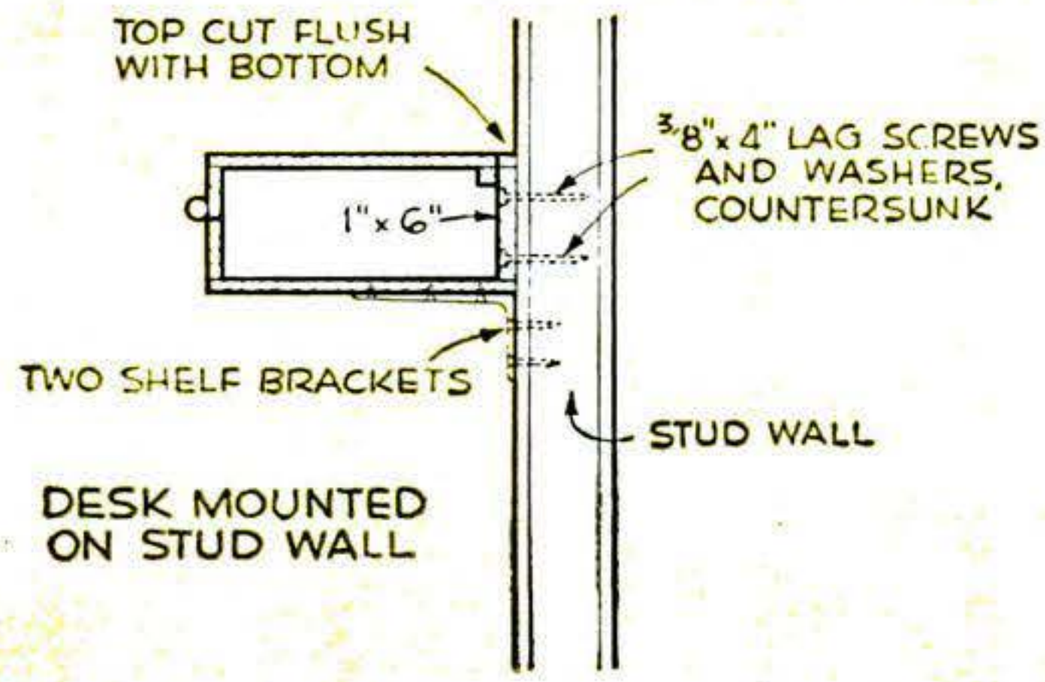
ALL your telephone gear—phone, phone book, pencils and writing paper—can be neatly concealed in this handsome and compact writing desk that hangs in mid-air.

The phone is housed in a compartment with holes in the bottom so you can hear it if it rings. Lift up the lid of the compartment to use the phone, and there's a grease pencil to write erasable memos (or doodles) on the smooth surface of the underside of the lid—a square of plastic-faced hardboard.

The basic desk can be installed on a window sill or against a flat wall, so there's no need for legs. Trim the length of the sill overlap to fit the width of your window, or ignore the overlap entirely if you're installing the desk on a wall.

Cut and assemble the one-by-six pine frame first; it establishes the shape and sweep of the desk curves. Place the frame over a panel of ½" plywood and draw a curved outline around the frame ends. Clamp this panel to another and cut the two





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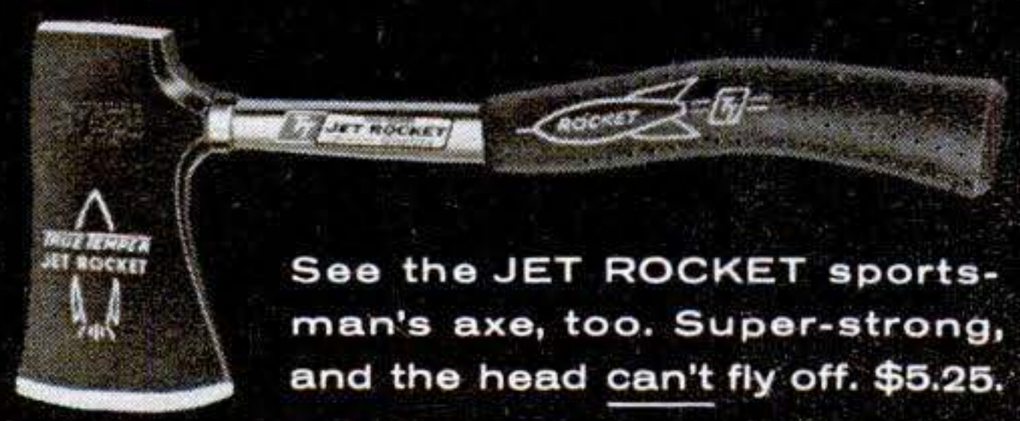

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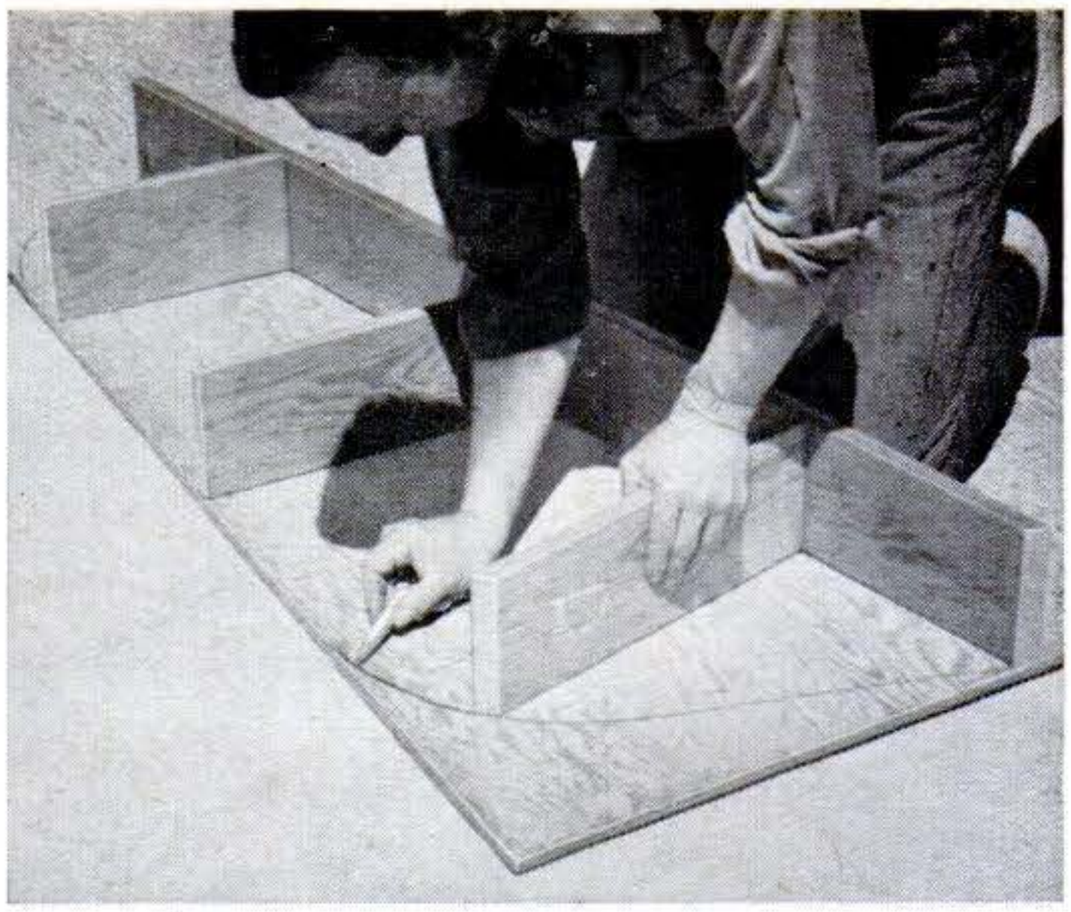
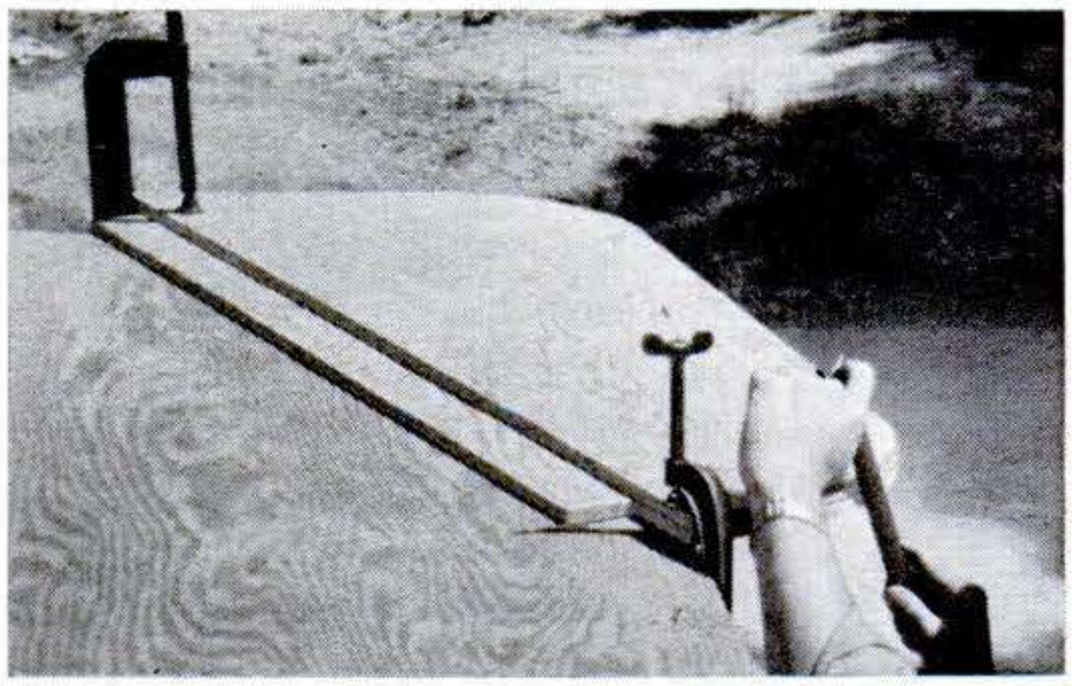
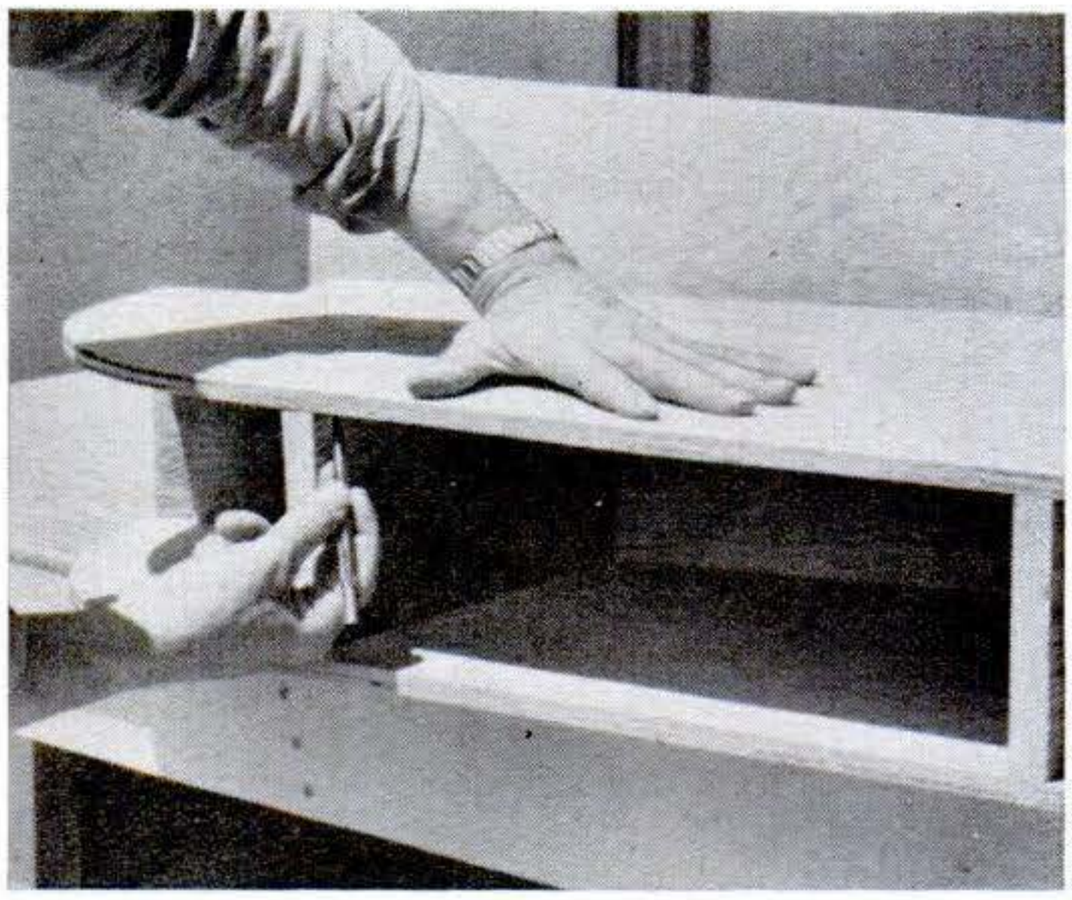


AFTER ASSEMBLING THE FRAME of one-by-six pine, place it on ½" plywood and, by eye, draw a curve that touches all the frame ends. Miters cut on the ends of the frame as indicated on the drawing help you shape the curve.



CLAMP TOP AND BOTTOM TOGETHER to shape them identically. If you don't have power tools, a wood rasp, followed by sandpaper—coarse and fine, in turn—will produce smooth edges, but check them often with a try square.



MARK THE INSIDE EDGES of the compartment on the plywood, and draw cutting lines ⅜" outside them so the lid joints will be centered over the dividers. Cut precisely on back line since the lid will be hinged to rear of compartment.

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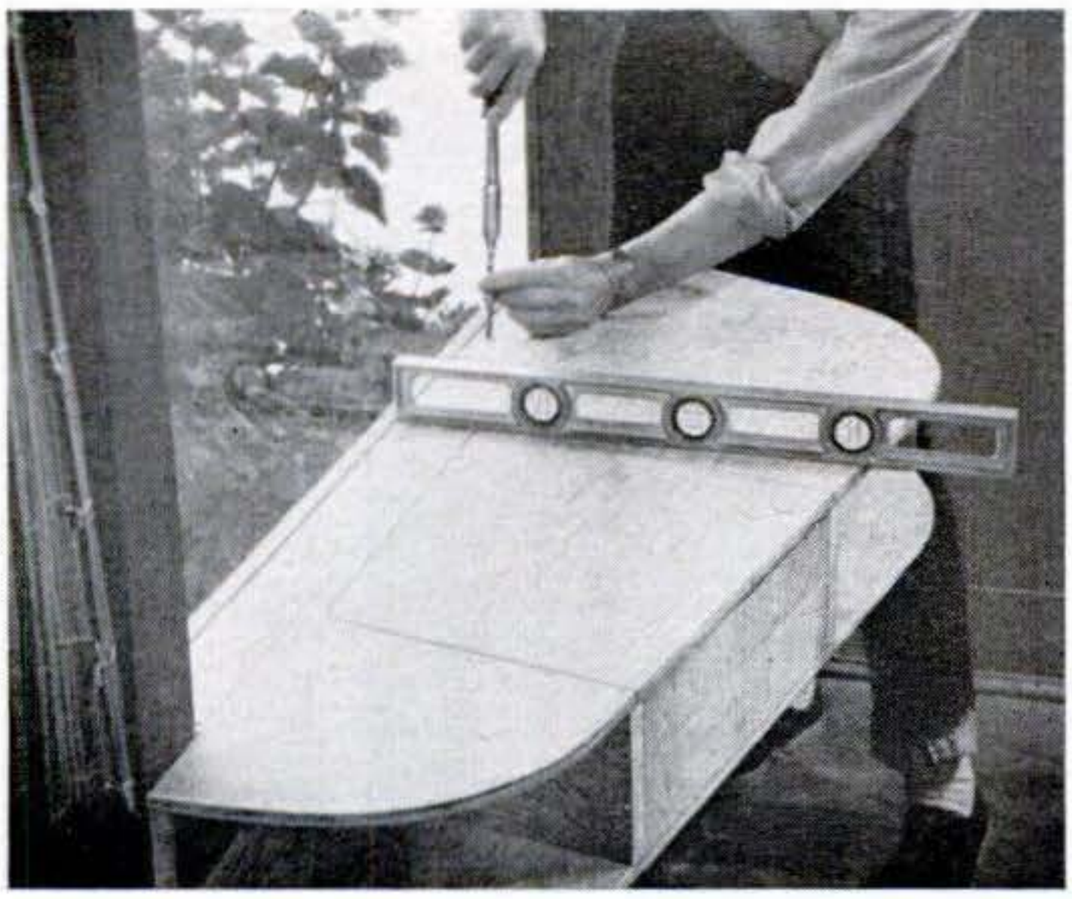
together, allowing enough extra width on the rear edge of the top to fit your sill, if you're planning a window installation.

Building in the phone is the trick—unless you want to pay a fee to the telephone company for installing it. (It's illegal to disconnect or tamper with telephone wiring.) To get it in the desk, cut a 1″ notch in the rear of the bottom panel, about 17″ from the left side, and place the phone wire in it. From this point on, you assemble the desk around this wire with the phone in place.

With the wire in the notch, nail the bottom to the frame. Put the top in position and lay out the cutting lines for the lid. After cutting the lid, complete the desk assembly, using glue and nails for rigidity. Hang the lid on Soss hinges—they're invisible when the lid is closed—and add the two-piece face to close the front of the phone compartment. Screw a ⅞″ dowel to the top face of the lid for a lifting handle.

Contact-cement a panel of plastic-surfaced hardboard or counter topping to the underside of the lid. Drill a shallow hole in the hinge cleat and press in a lipstick case or a .38-cal. cartridge case to make a holder for the pencil.

Nail ¼″-square cleats inside the one-by-sixes on the right side of the desk for a ¼″ plywood shelf to hold the phone book and writing paper. Finish off the job by painting or varnishing the desk to match the room furnishings or the surrounding woodwork.



LEVEL THE DESK TOP and drive screws through the overlap to fasten it to the window sill. Lag screws through the rear one-by-six into the wall studs will pull the desk up snug. See drawing on other page for wall-installation details.

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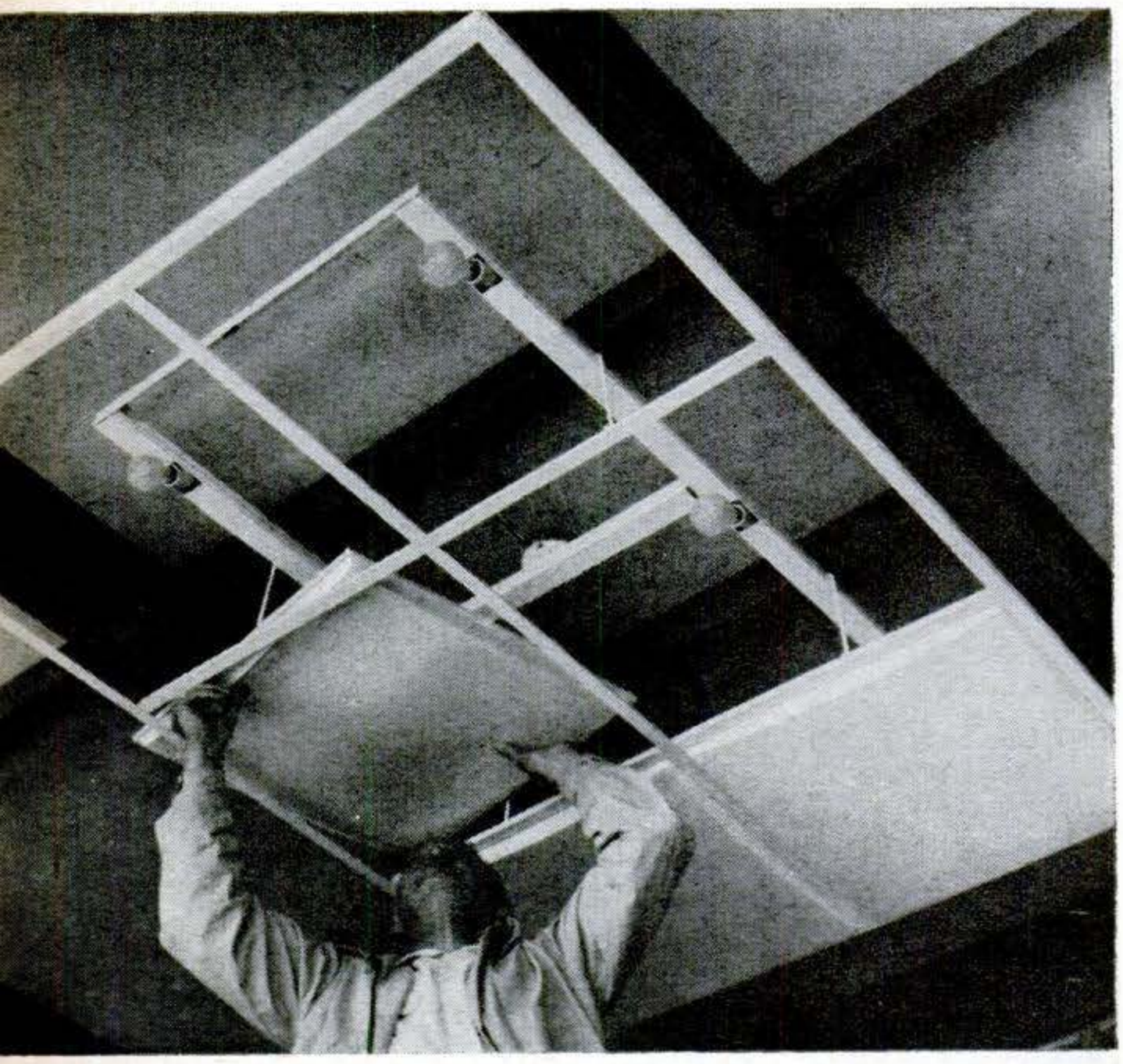
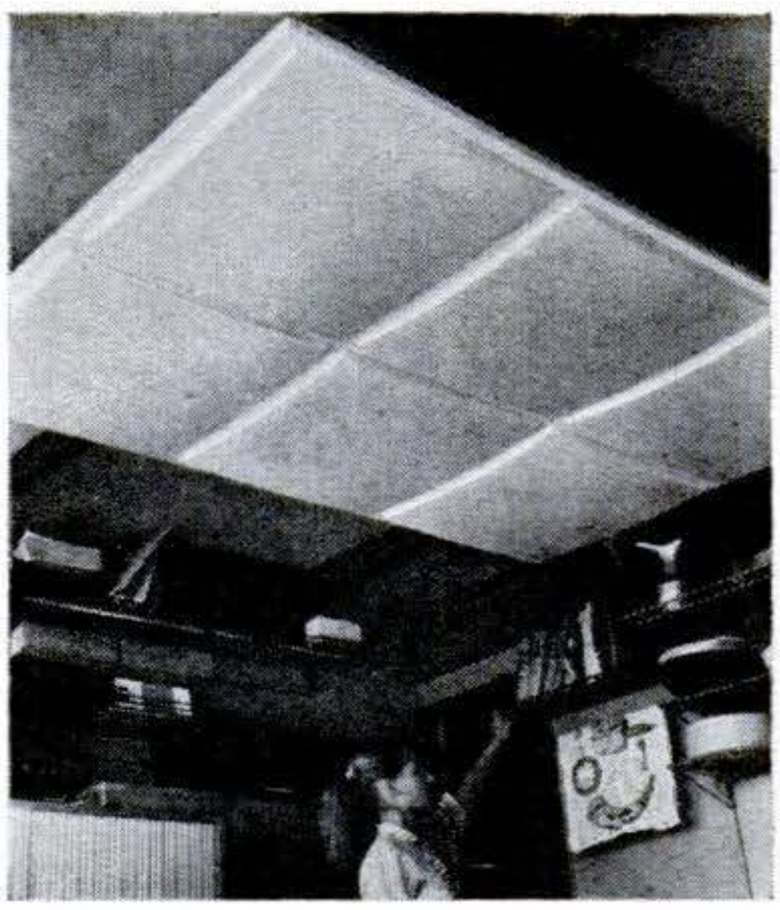
Two Ways to Install a Luminous Ceiling

A MODERN luminous ceiling gives you soft, glare-free lighting. Such ceilings are now being installed in many luxury homes. They are ideal for kitchens, bathrooms, dining areas, even a workshop—any place where bright, uniform light is important.

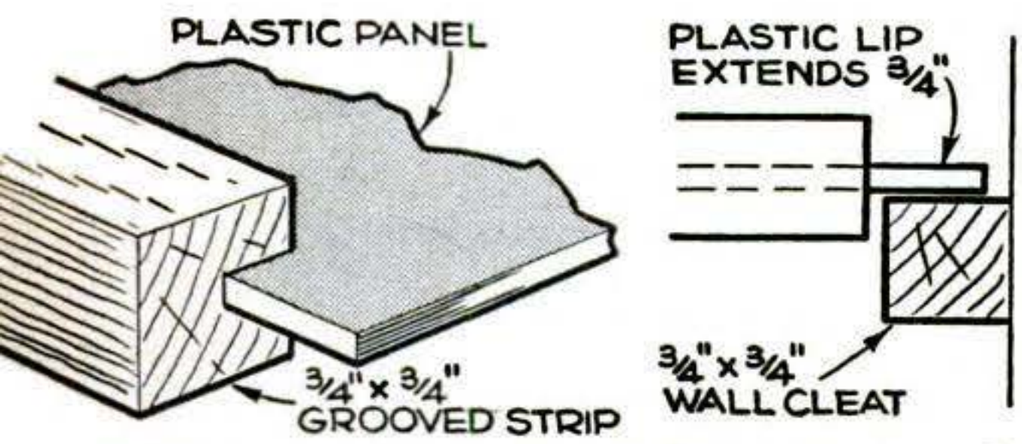
You get a bonus, too: A luminous ceiling—essentially a new ceiling dropped below the existing one—hides old, cracked surfaces and outdated fixtures, yet permits use of the existing fixtures and wiring.

You can put up a luminous ceiling in two ways. You can buy one ready-made, complete with lighting, in several styles and sizes; or you can make your own by suspending panels of translucent fiber-glass in frames. Use approved porcelain sockets or fluorescent fixtures.

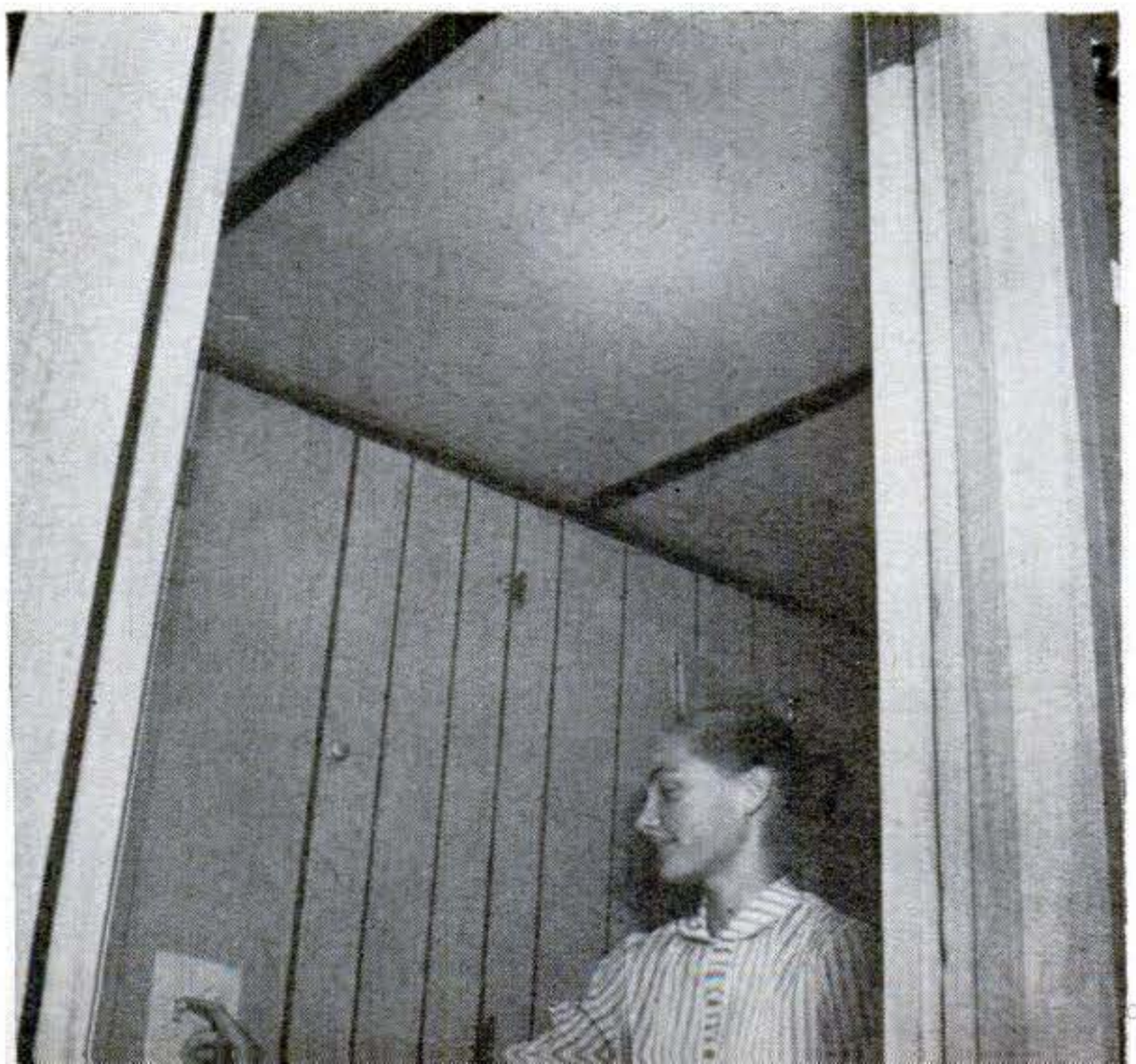




READY-MADE CEILING SECTION comes in a prewired kit of hanging metal grid with plastic inserts. Called "Sunshine Ceiling," it costs about $77 for 4′-by-6′ size here, $66 for 4′-square model. It's sold by John C. Virden Co., 6103 Longfellow Ave., Cleveland.



HOMEMADE CEILING can be put up with flat panels of frost-white fiber-glass (Filon) held in grooved strips. Panels extend 3/4" beyond the strips at each side and rest on cleats nailed to the wall (sketch above). The fiber-glass is available in thin sheets. Keep panels 8" below old ceiling with incandescent bulbs, 4" where fluorescent lighting is used. Leave small gaps between panels or at ends for ventilation.



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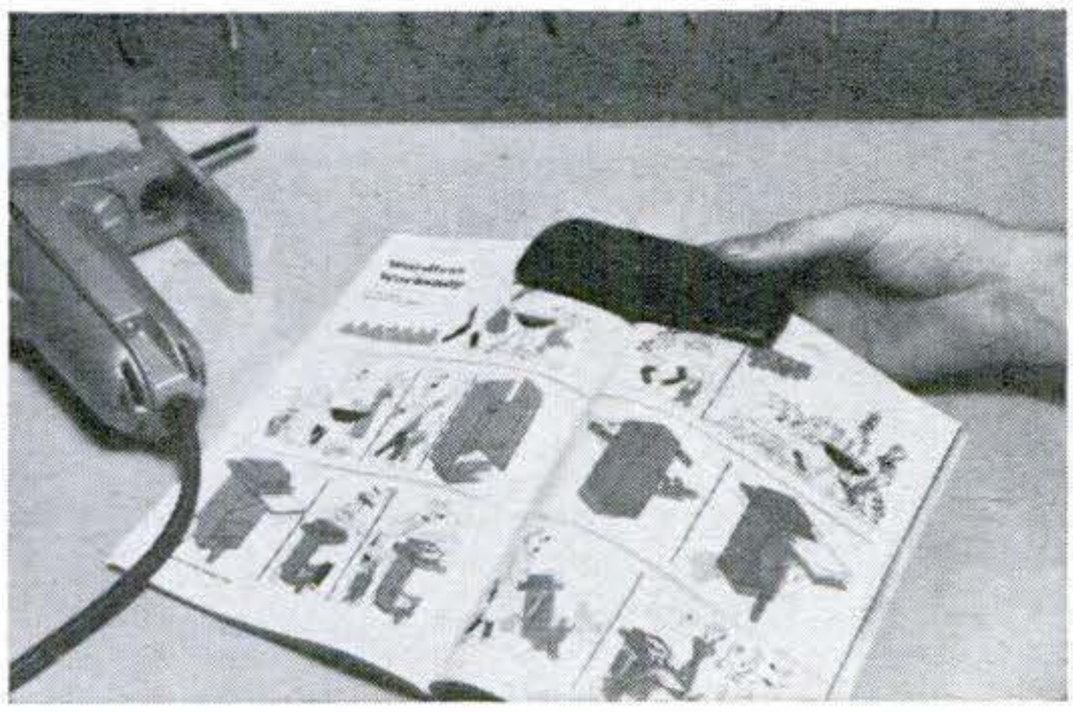
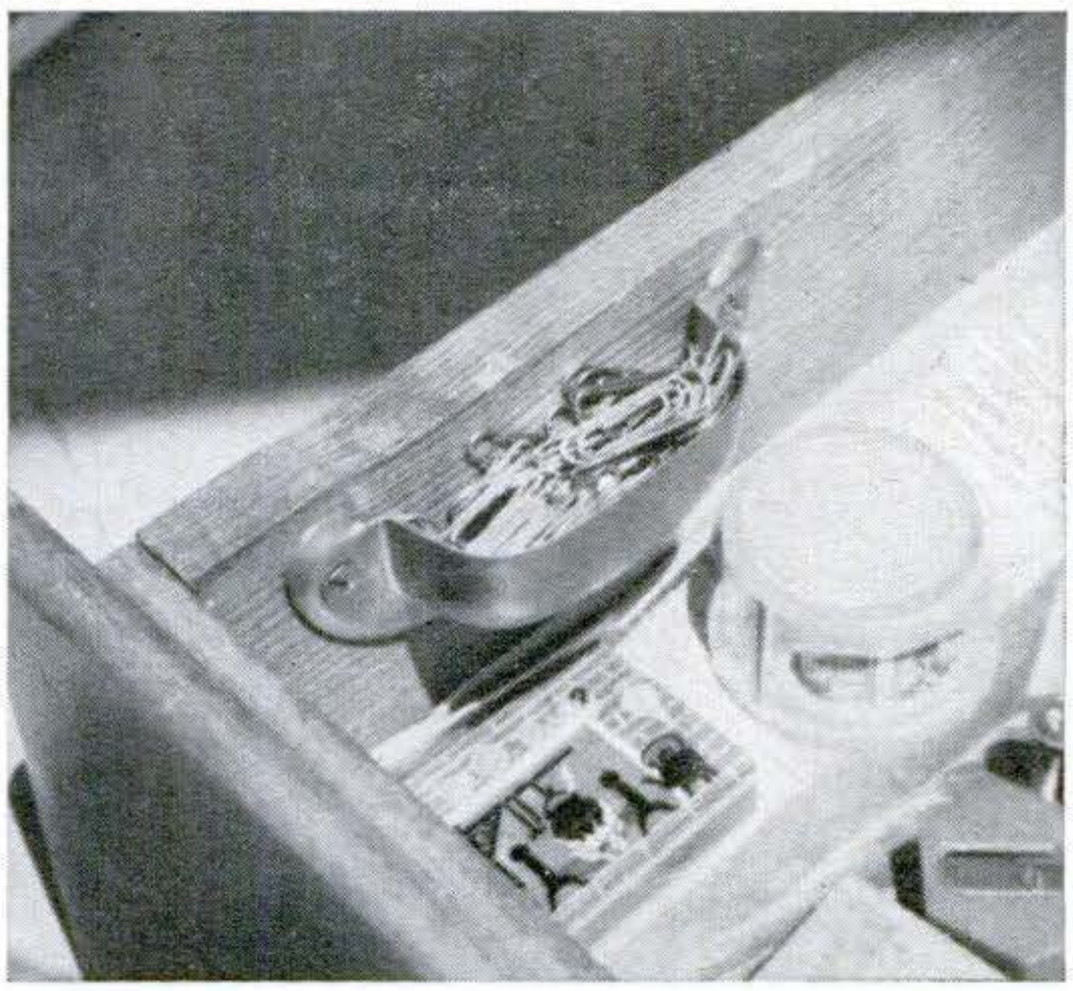
Short Cuts and Tips

FROM PS READERS



Eyeglass Case Holds Book Open

MY SPRING-HINGED eyeglass case makes a handy clamp. I use it to hold my favorite magazine open to a page of plans while I'm working on one of the projects. —*James C. Adams, Scranton, Pa.*

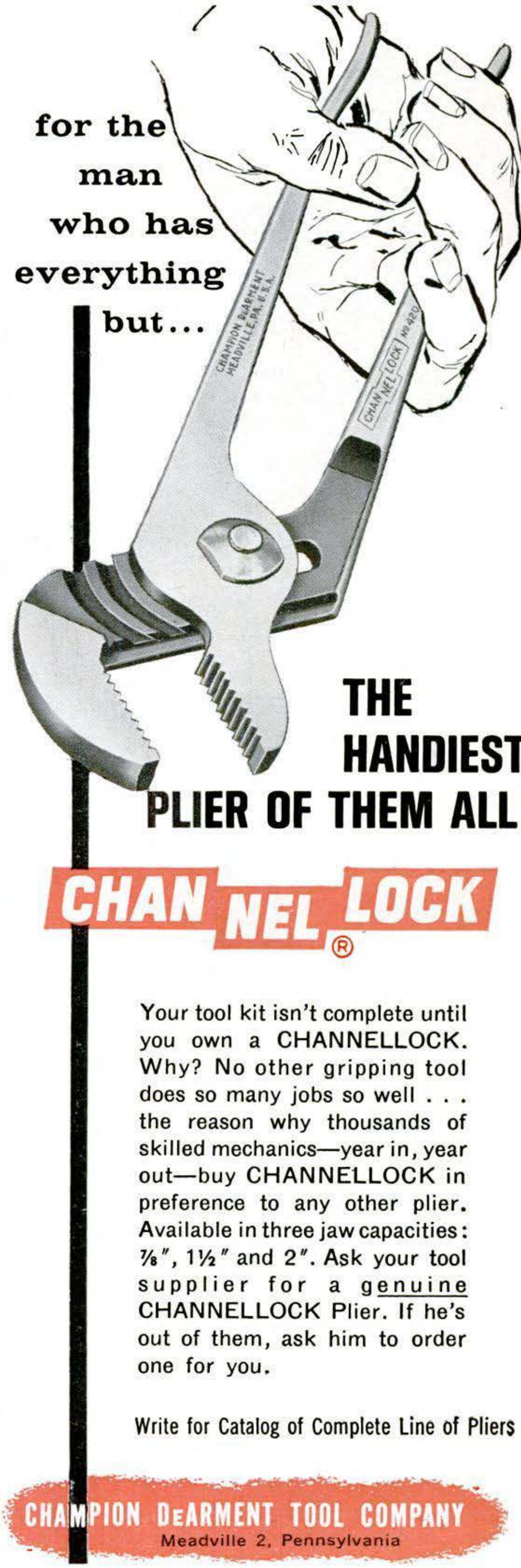


Drawer-Pull Storage Bin

AN ORDINARY drawer pull, fastened to the inside of a desk drawer, will make a handy bin for small articles such as paper clips. Put a row of them in a shop drawer, or along one side of a bench, to provide handy storage places for small parts. —*Robert Hurst, Ventura, Cal.*

▶▶▶WHEN short tacks are needed and you have none at hand, make them. Cut and point long tacks by snipping them diagonally with cutting pliers.—*Mees Trussell, Berkeley, Cal.*

for the man who has everything but...



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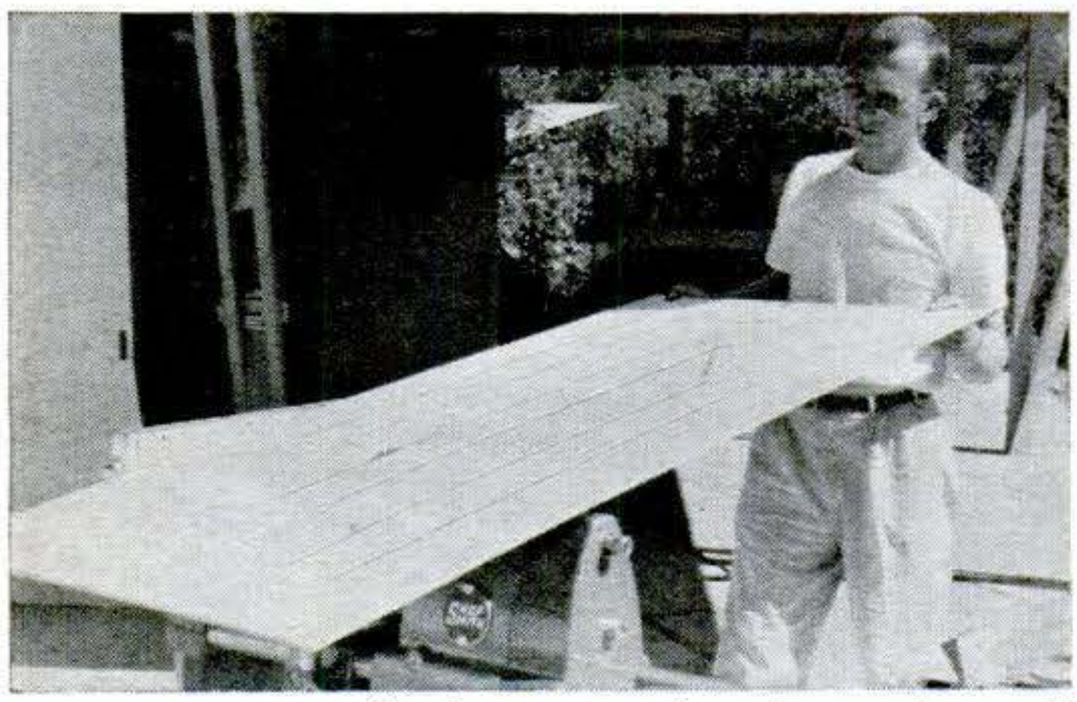
HOW TO Dress Up Plain Doors

THE stark look of a panel door can be relieved by cutting into the panel and weaving it into an interesting pattern. Besides being attractive, the open pattern makes airy doors between rooms or provides ventilation for a closet. Here ¼″ plywood was used, set in a grooved frame of one-by-four pine.

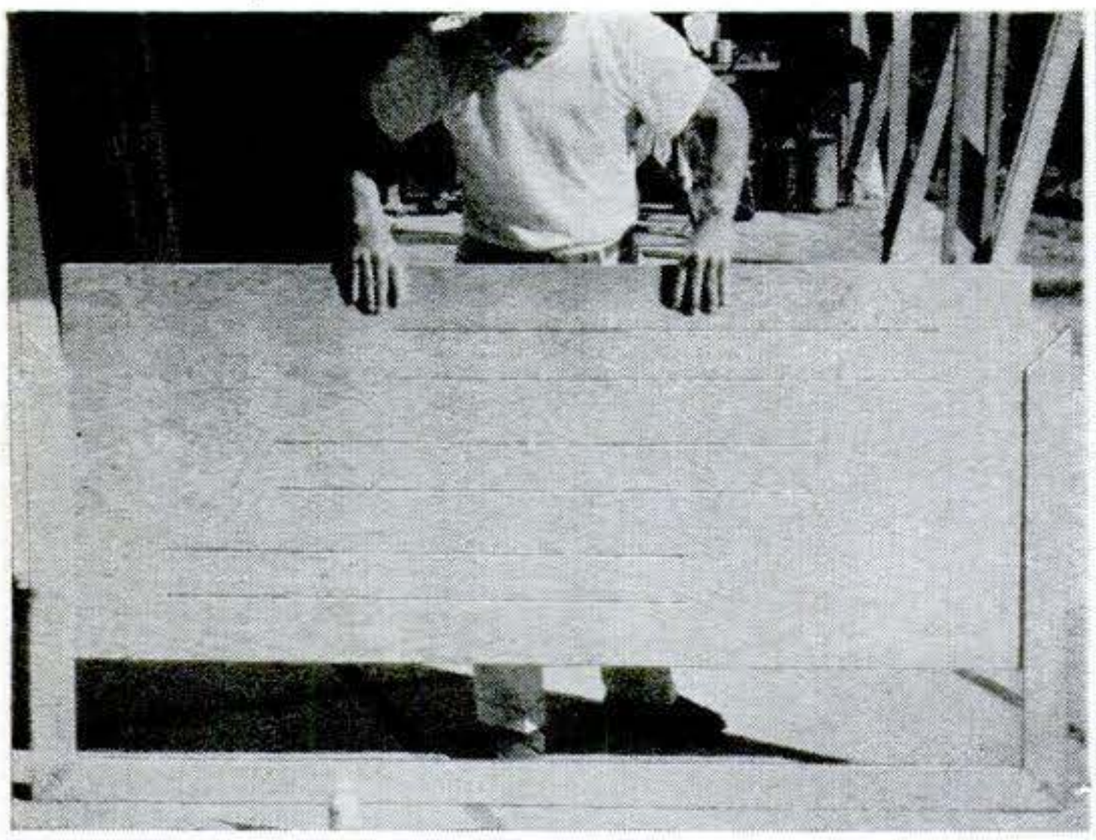
Cut the panel to size, and lay out the pattern—in this case just pairs of parallel lines at staggered heights.

Make a plunge cut on each line by dropping the panel on a rotating table-saw blade, or by lowering a portable circular saw into the wood and guiding it to the end of the line.

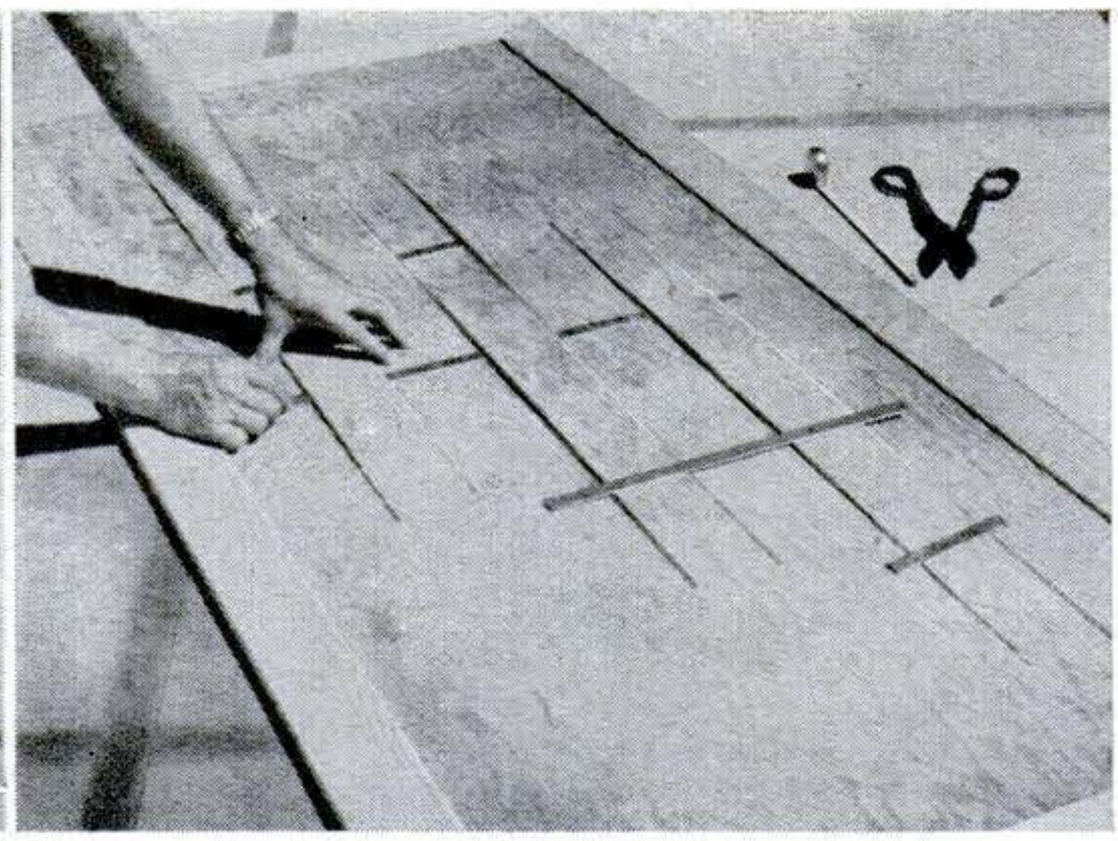
After framing the panel, weave strips of sheet metal or hardwood in and out of the saw cuts. Place a small wood block under the portion to be raised, while you press down on the surrounding area and insert the strips. No fastening is needed. Tension of the plywood will hold the strips in place. Paint or varnish will strengthen the bond.



MAKE THE CUTS by lowering the plywood panel on the rotating saw blade. Push the panel along the fence to cut to the end of the line.



SLIDE PANEL INTO GROOVES of three-sided frame. Glue on the fourth side to complete assembly. Check squareness before the glue sets.



INSERT STRIPS of metal or hardwood through saw cuts to create woven effect. Sand smooth, and paint or varnish both sides of the door.

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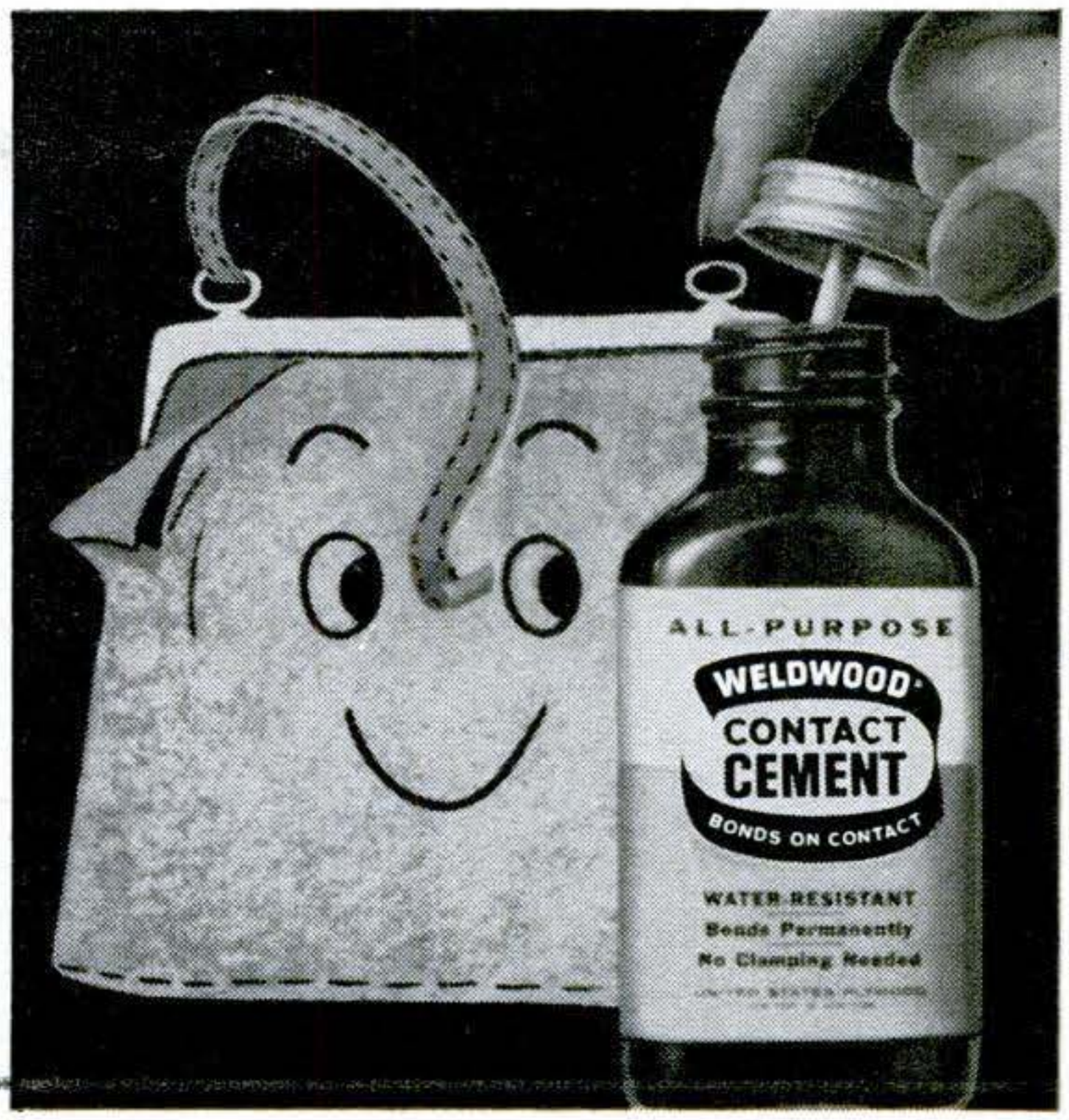
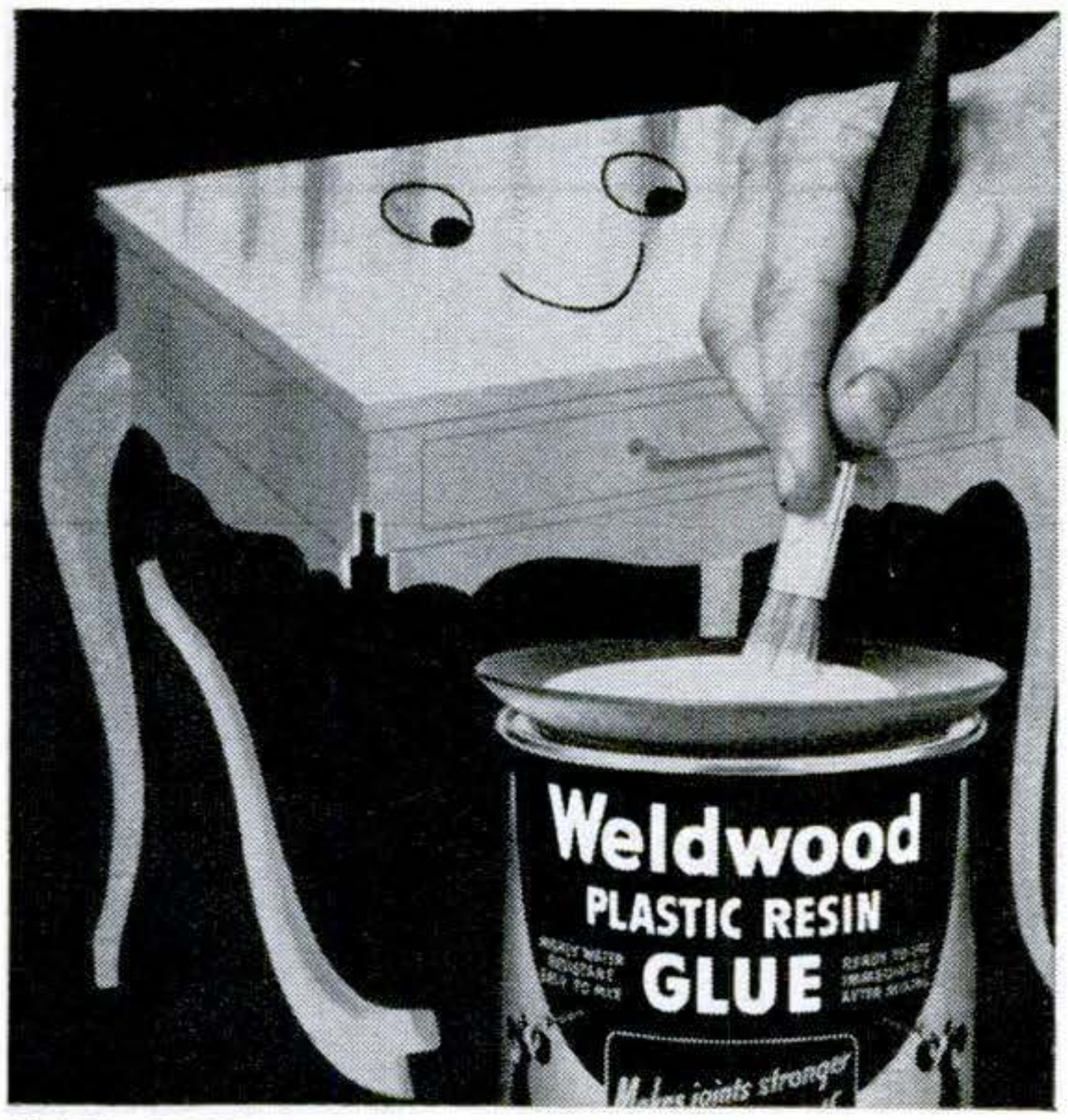
There's a Weldwood Adhesive for just about every gluing job

QUICK, CLEAN Presto-Set® Glue, the all-purpose glue, bonds paper, wood, cloth, china. Dries fast, won't stain. Handy new bellows-action squeeze bottles with spreader tops. From 39¢.



EASY-TO-USE Weldwood Contact Cement bonds leather, wood, plastic instantly, permanently, on contact. Needs no clamping; water-resistant, stays flexible when set. From 29¢.



STRONGEST of them all is Weldwood Plastic Resin Glue. Nothing like it for heavy-duty jobs. Makes joints even stronger than the wood itself. Mixes instantly, is water-resistant. From 40¢.

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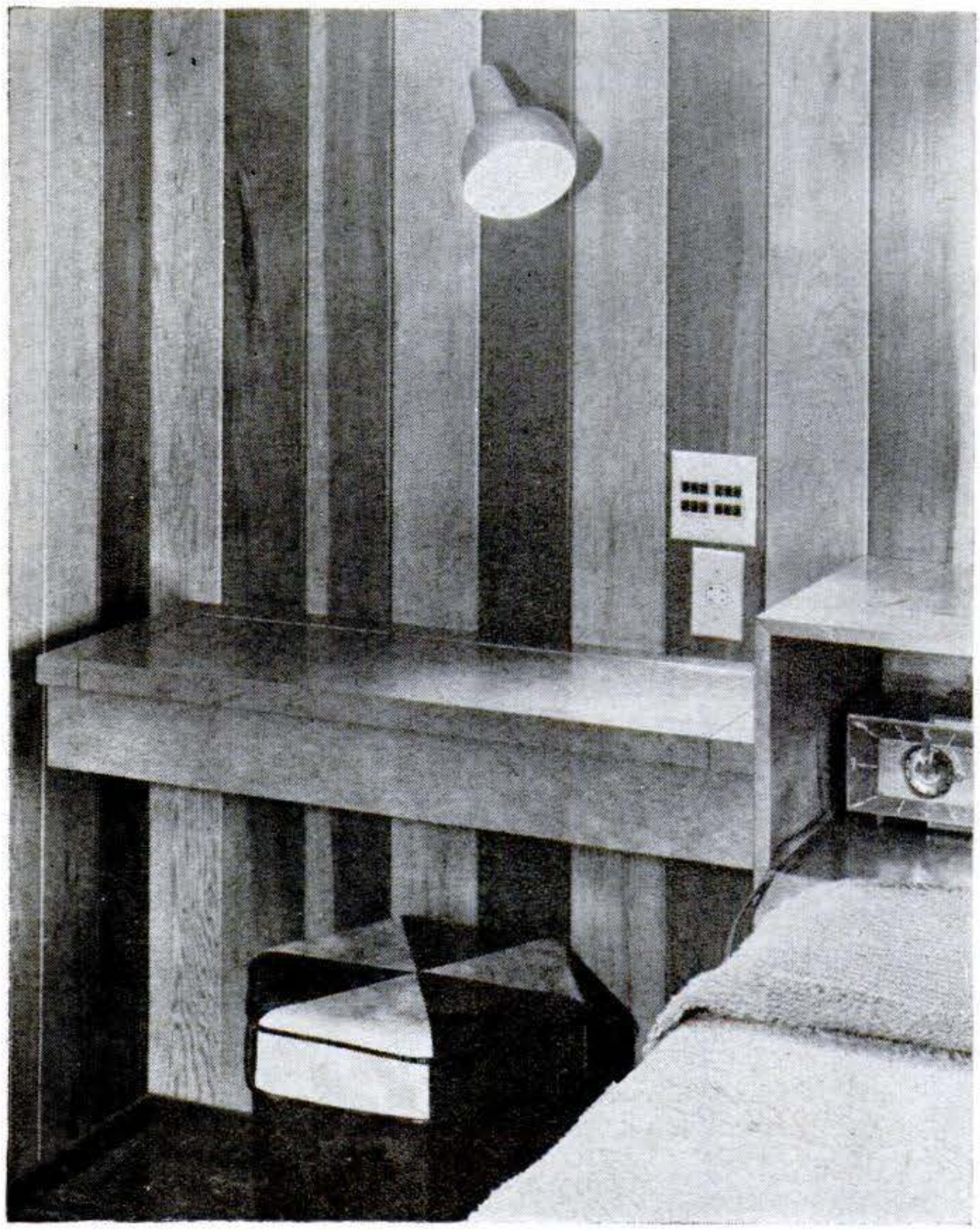
Plywood Wall Vanity

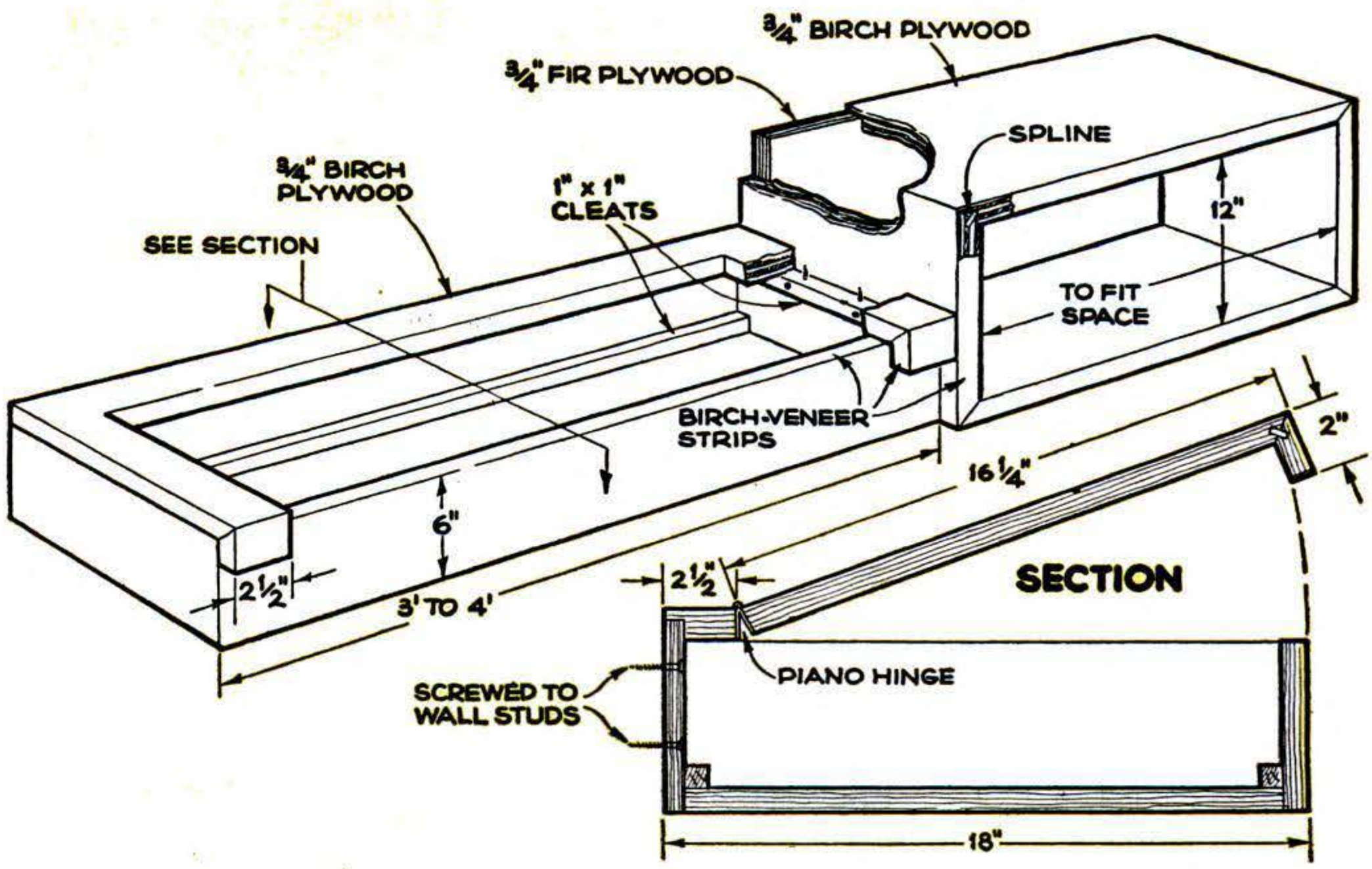


CLEAN lines and a spacious storage compartment for cosmetics and toilet articles make this built-in vanity a practical addition to a bedroom.

A boxed-in shelf, combined with the wall table, can be made long enough to fill out a blank wall or stretch across the top of a bed as a built-in headboard.

The table and shelf shown were built from ¾" birch plywood. To cut cost, you might use fir plywood for parts not seen, such as the backs and the bottom of the table.

Mitered joints were used throughout, with exposed edges covered with birch-veneer strips. Note how the lid and its surrounding frame overlap the apron to give a look of thickness. When the lid is raised, a mirror cemented or screwed to the underside appears.



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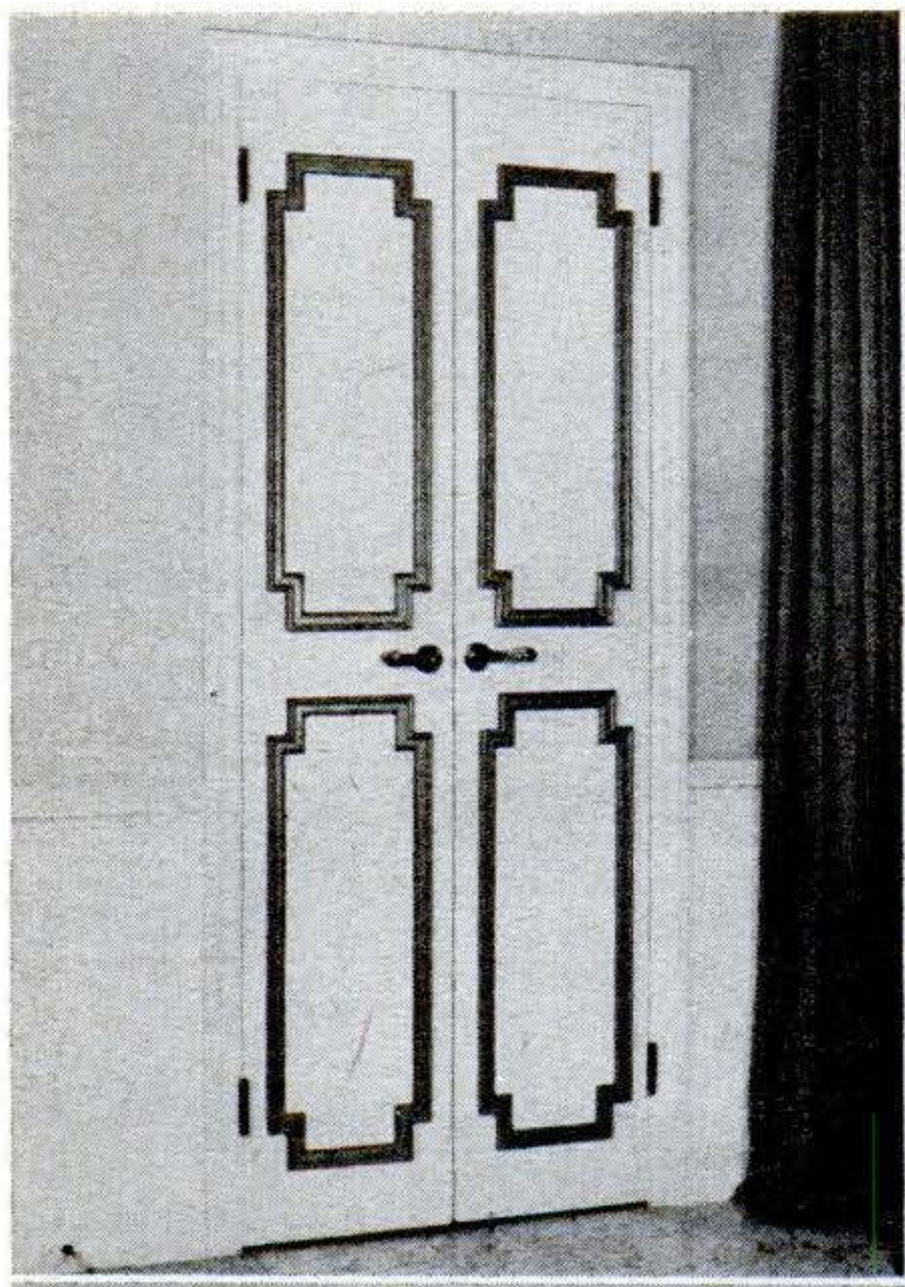
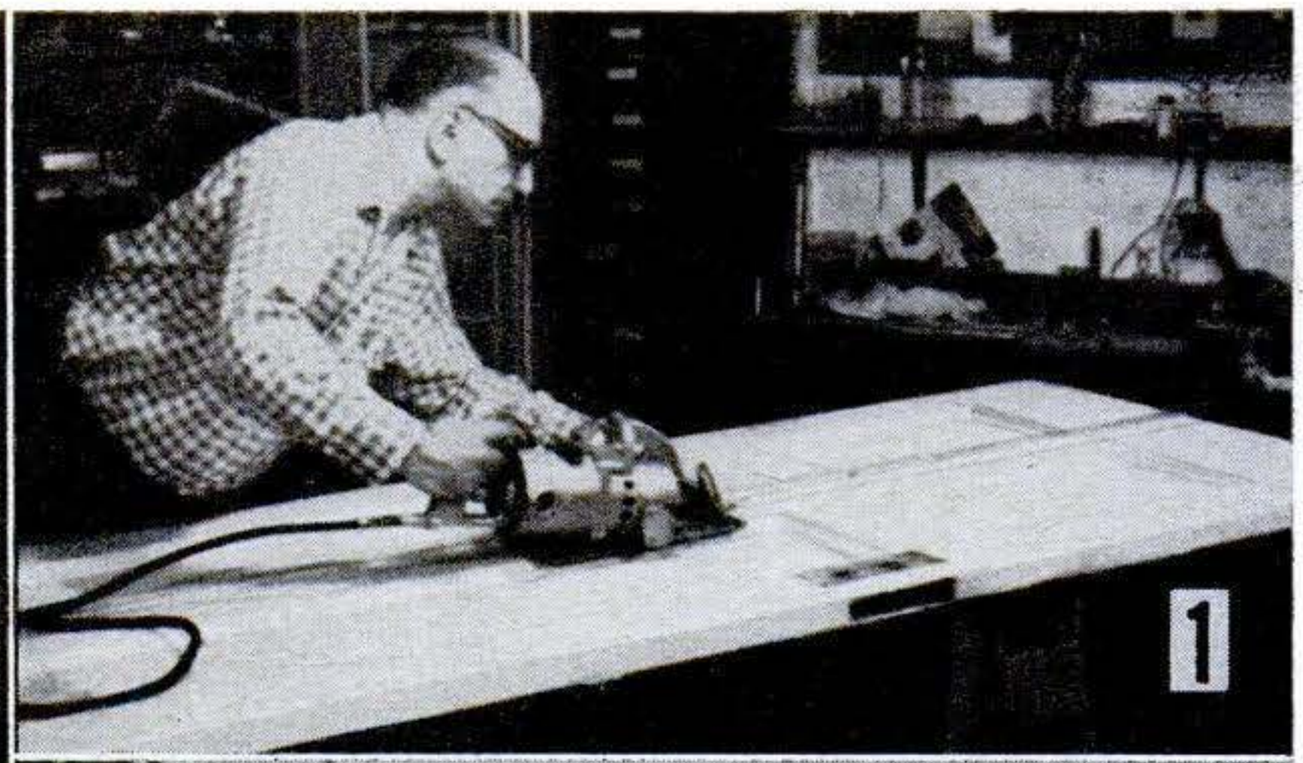
TWIN DOORS can be better than one

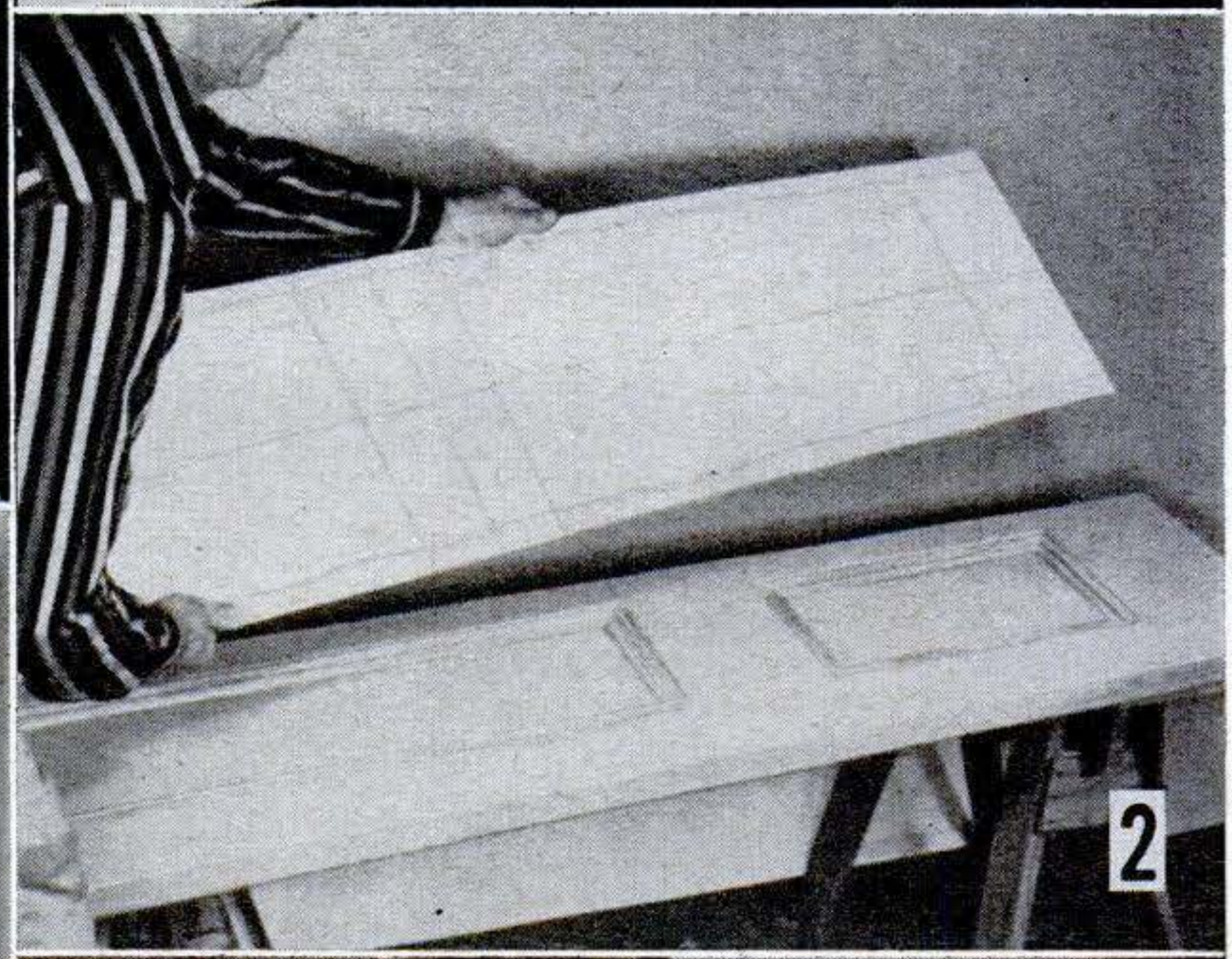
SPLITTING an old-style wide door down the middle is a fine way to reduce the swing in a crowded area. You can also remodel it for better appearance.

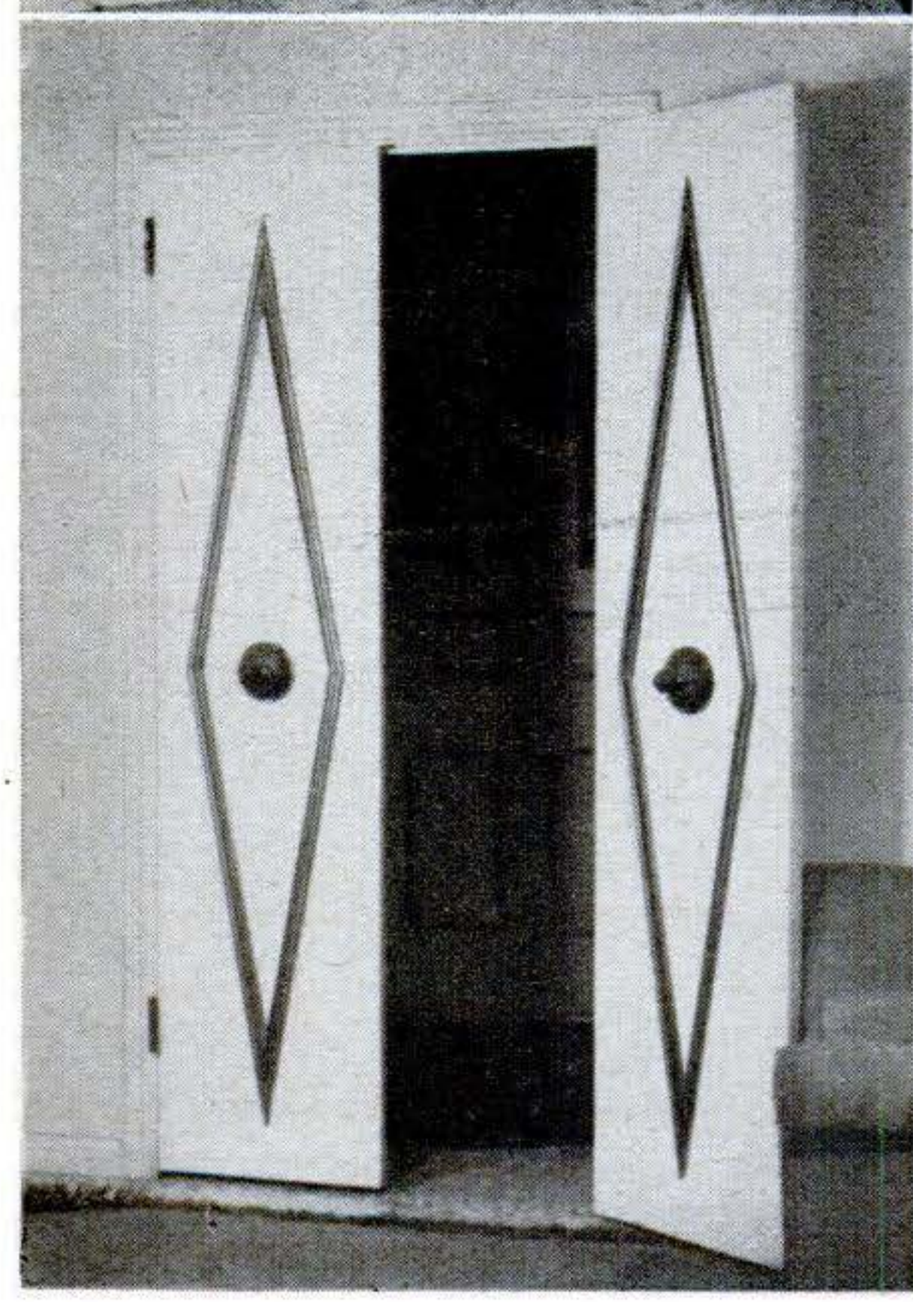
Cut the door along its center (1) to get two of equal width. Glue 1/8" or 1/4" hardboard over each one to conceal the old paneling (2). Sand the edges flush. Create a new twin design with molding nailed on the hardboard (3).

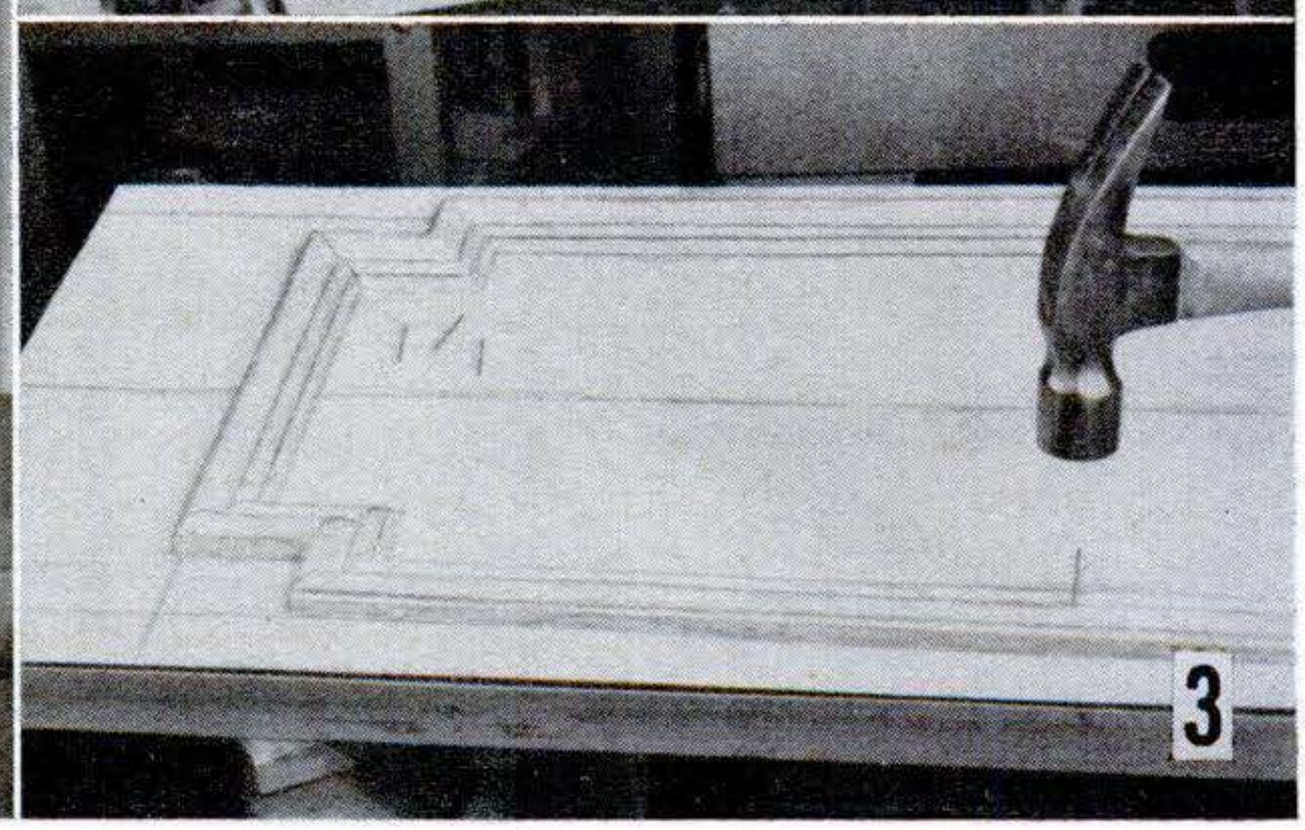
Reset the stops in the doorway to adjust for the new thickness, and hang the doors. Add double handles and magnetic closure stops to hold the doors shut.











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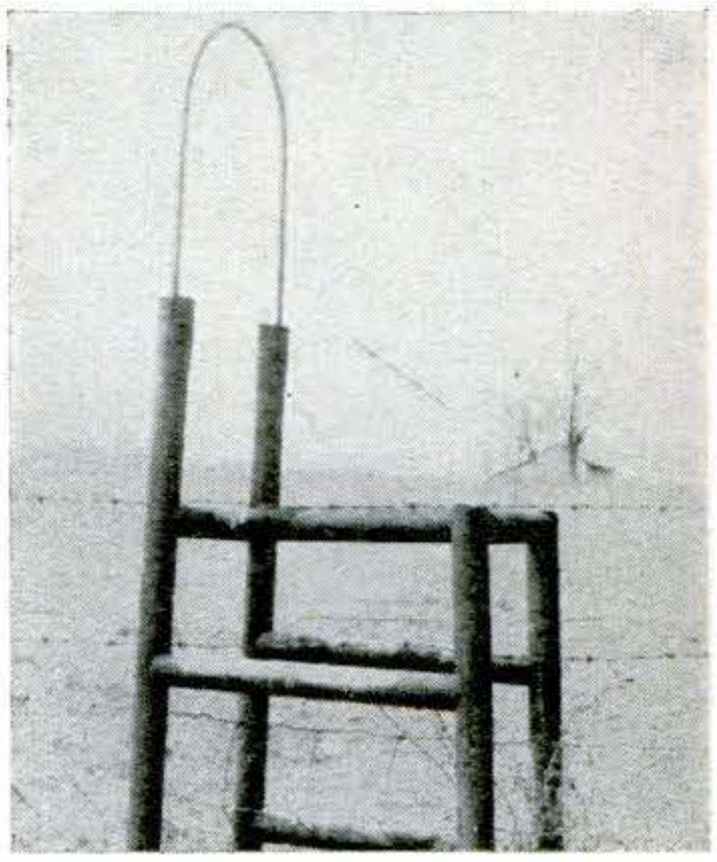
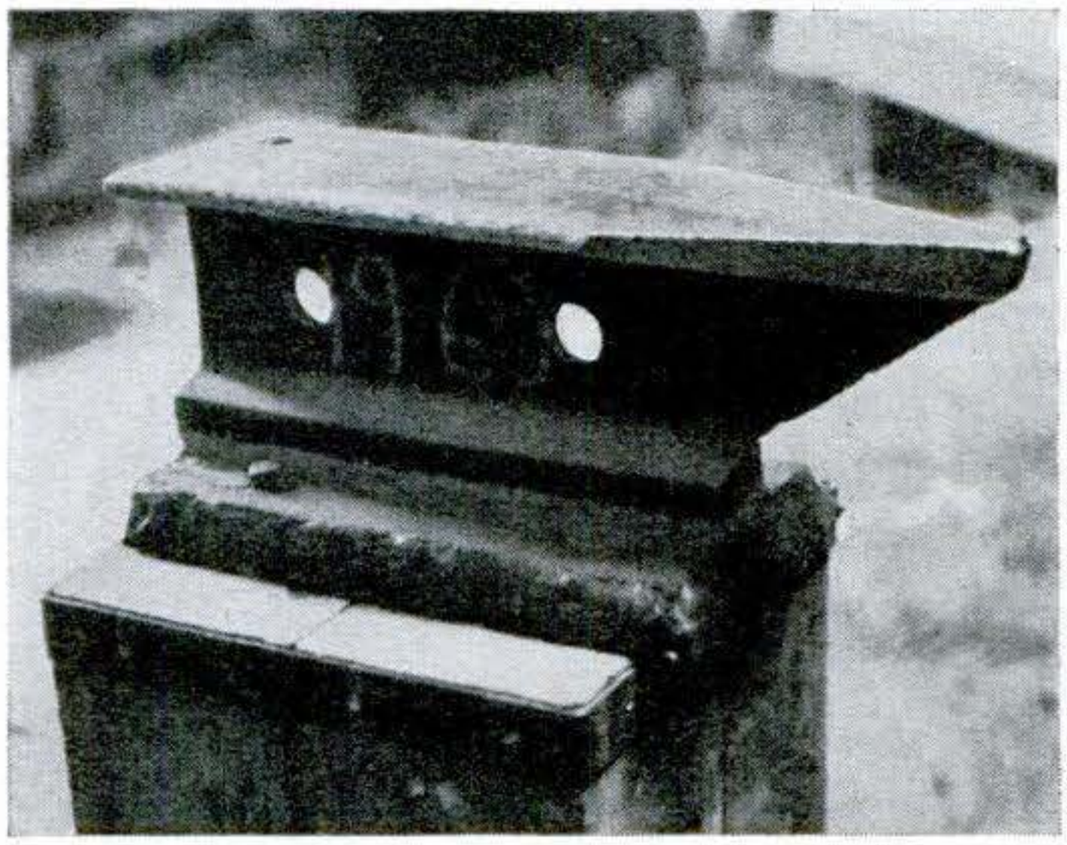
Short Cuts and Tips

FROM PS READERS



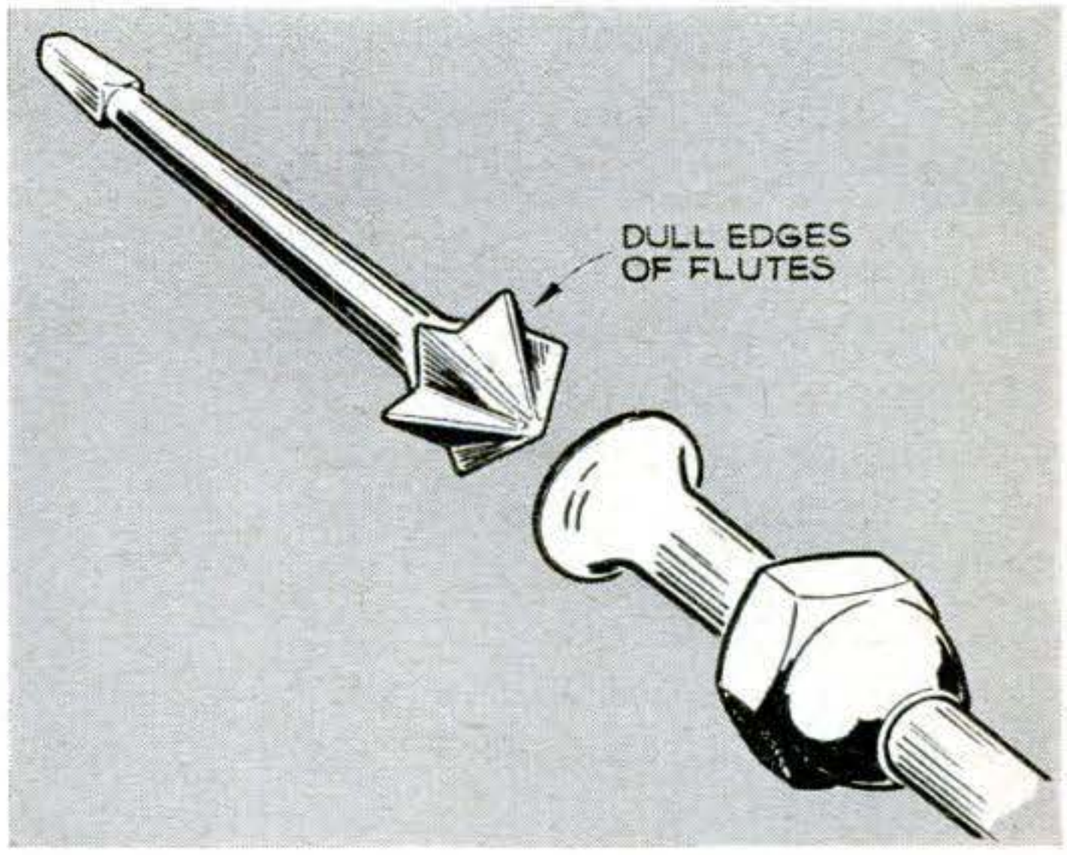
Stile Welded from Pipe

A FEW pieces of discarded 2″ iron pipe were welded together to make this rural fence stile. The curved hand grip welded to the tall vertical members is a piece of ½″ pipe.—*Grover Brinkman, Okawville, Ill.*



Anvil Made from Railroad Rail

ANVILS sell for as much as $40 where I live and there aren't many of them. So I made my own from a short length of railroad rail. I tapered one end with an acetylene torch to form the horn and welded the rail upside down to a heavy metal base. The piece weighs 55 pounds and has the musical ring of a real good anvil.—*John Curoe, Bernard, Iowa.*



Old Countersink Flares Tubing

AN OLD discarded countersink makes a good tool for flaring the ends of copper tubing to fit compression joints. File off the sharp flutes so they won't chew the metal. Rotating the countersink backwards while you press it in will make the flare more uniform and keep the flutes from digging into the soft copper.—*W. C. Wilhite, Carlinville, Ill.*

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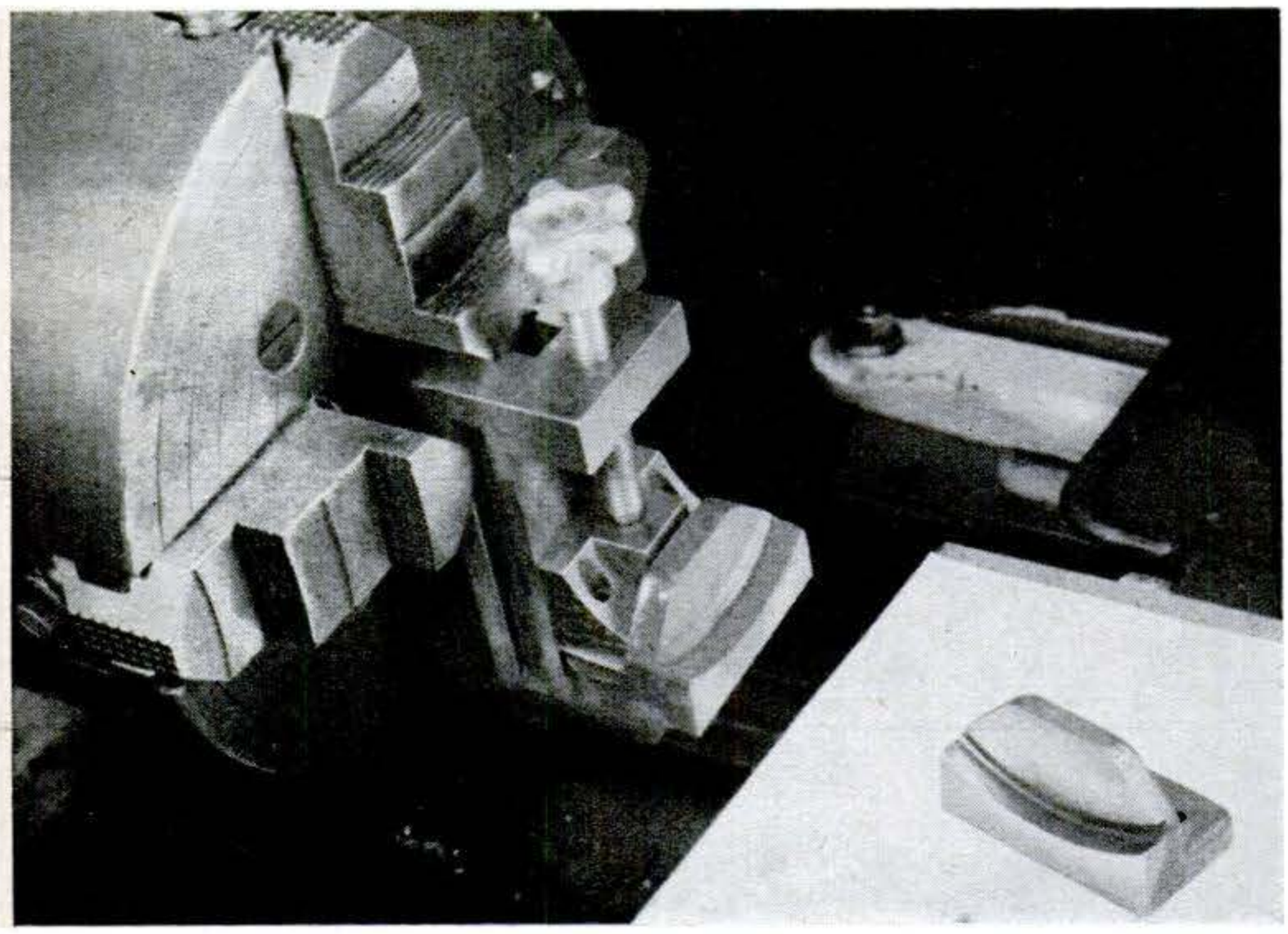
How to Chuck Odd

To a good machinist, a job that "can't be done" simply takes a little longer. Here's how to do four impossible jobs

AMONG machinists, you can tell the men from the boys by their ability to improvise solutions for tough jobs that can't be handled according to the book. Experience plus imagination make the difference.

How, for example, would you set up a finished sphere for additional machining in the lathe? Form an irregularly shaped curved piece? Grip odd-size stock accurately when ordinary collets don't have the range to fit it? Or face a bundle of rods in one turning operation? The answers are deceivingly simple—but it took brains to figure them out, as you will see on these two pages.

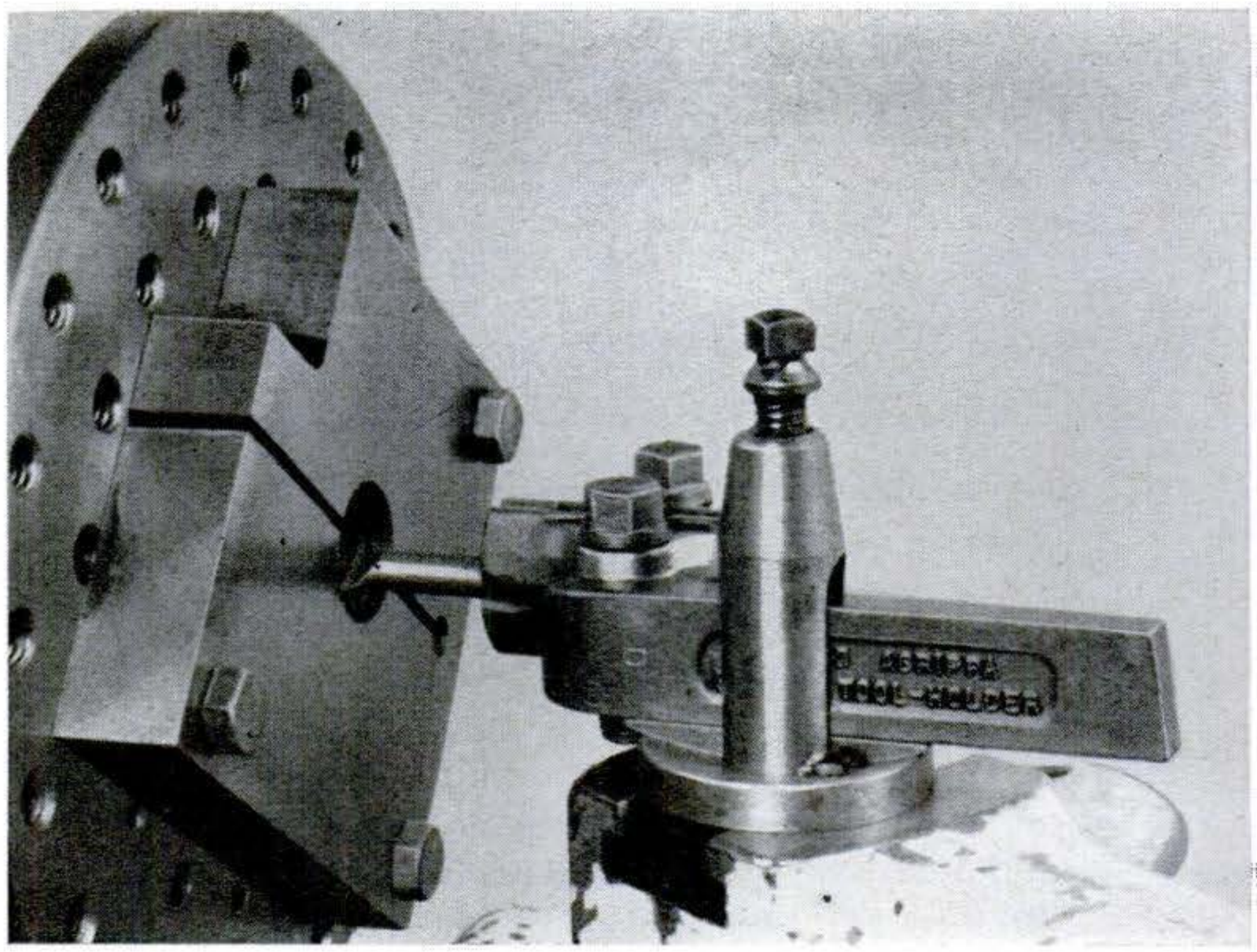


Curved pieces like the one shown in the inset at left can be easily machined to an accurate radius in the lathe. First clamp the part in a toolmaker's or drill-press vise. Then chuck the vise in the four-jaw lathe chuck. Adjust the individual jaws to place the workpiece in a position that will give the required radius. For extreme accuracy, set the radius with an inside mike mounted on the tailstock.

Where the accuracy of a collet is required, but the stock is odd-size or too large for your collet range, fasten a slotted steel plate to the lathe faceplate with three bolts arranged as shown, so that one corner of the plate is free to spring in and out.

Bore an opening in the slot, centered and exactly the diameter of the work to be held (photo at right). Insert the work in the hole and tighten it by drawing up the cap screw (arrow in photo at far right) to pull the split plate together.

When the job's done, save the plate. You can rebore it for work of larger diameter.



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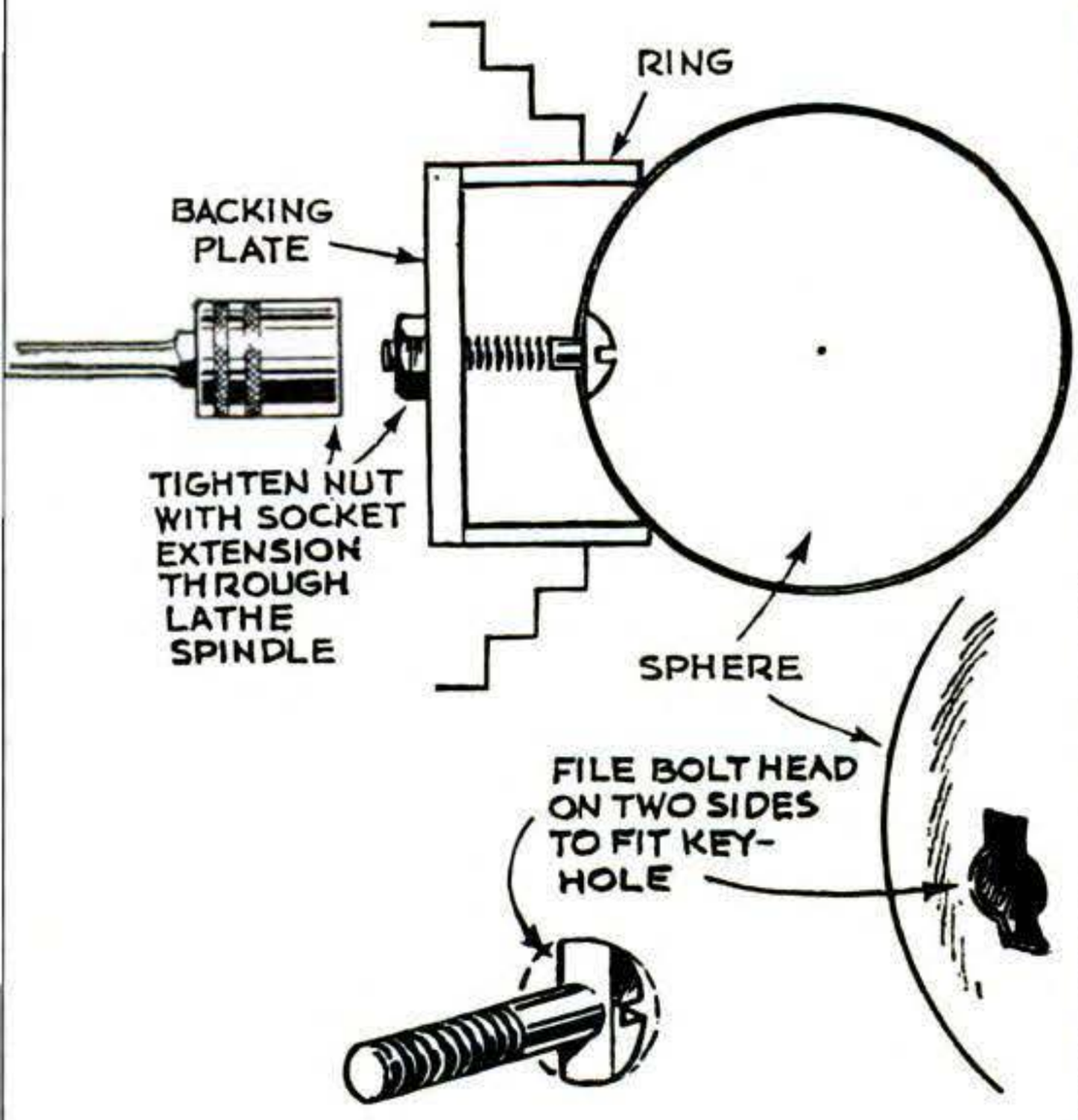
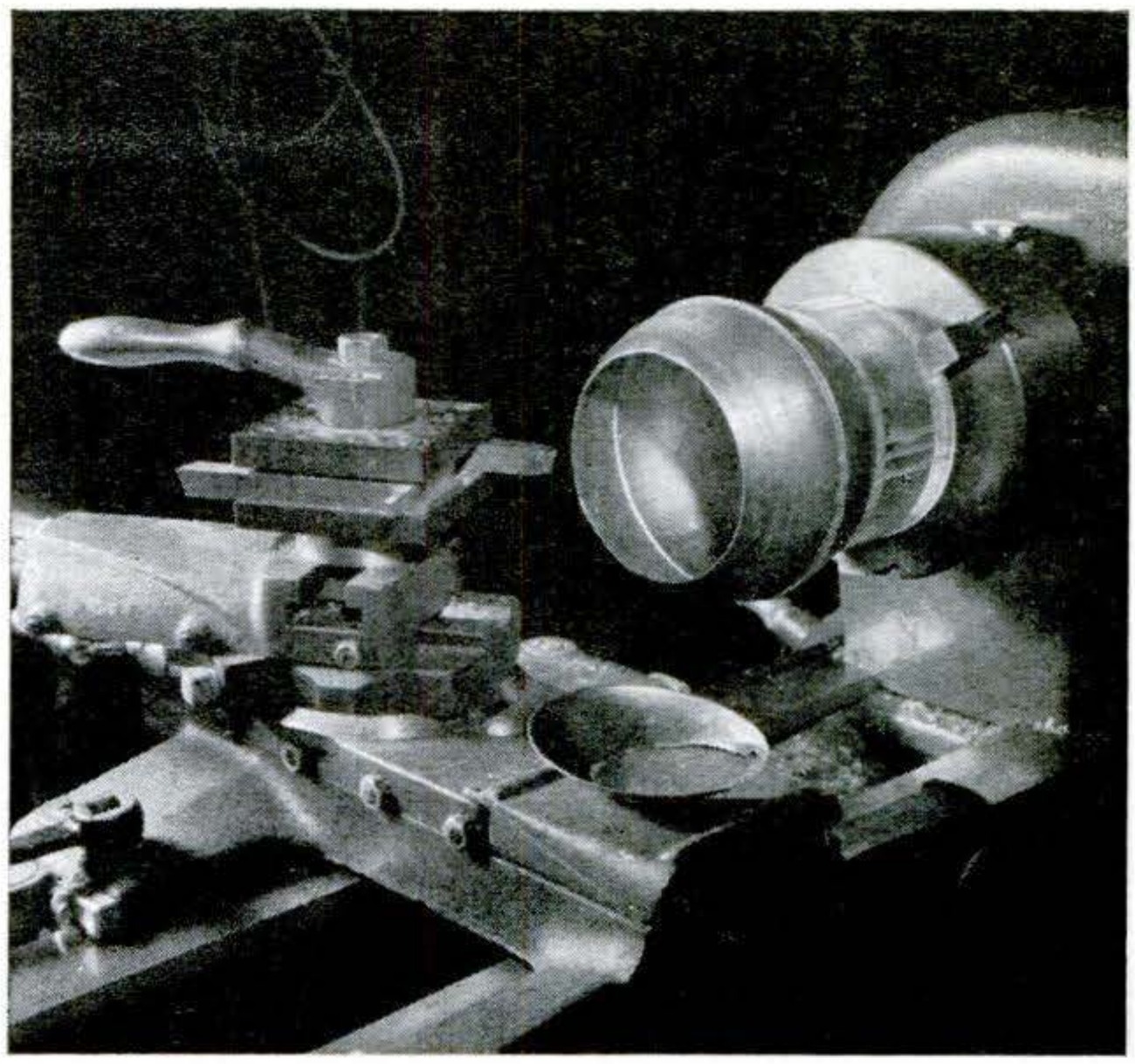
Shapes in the Lathe



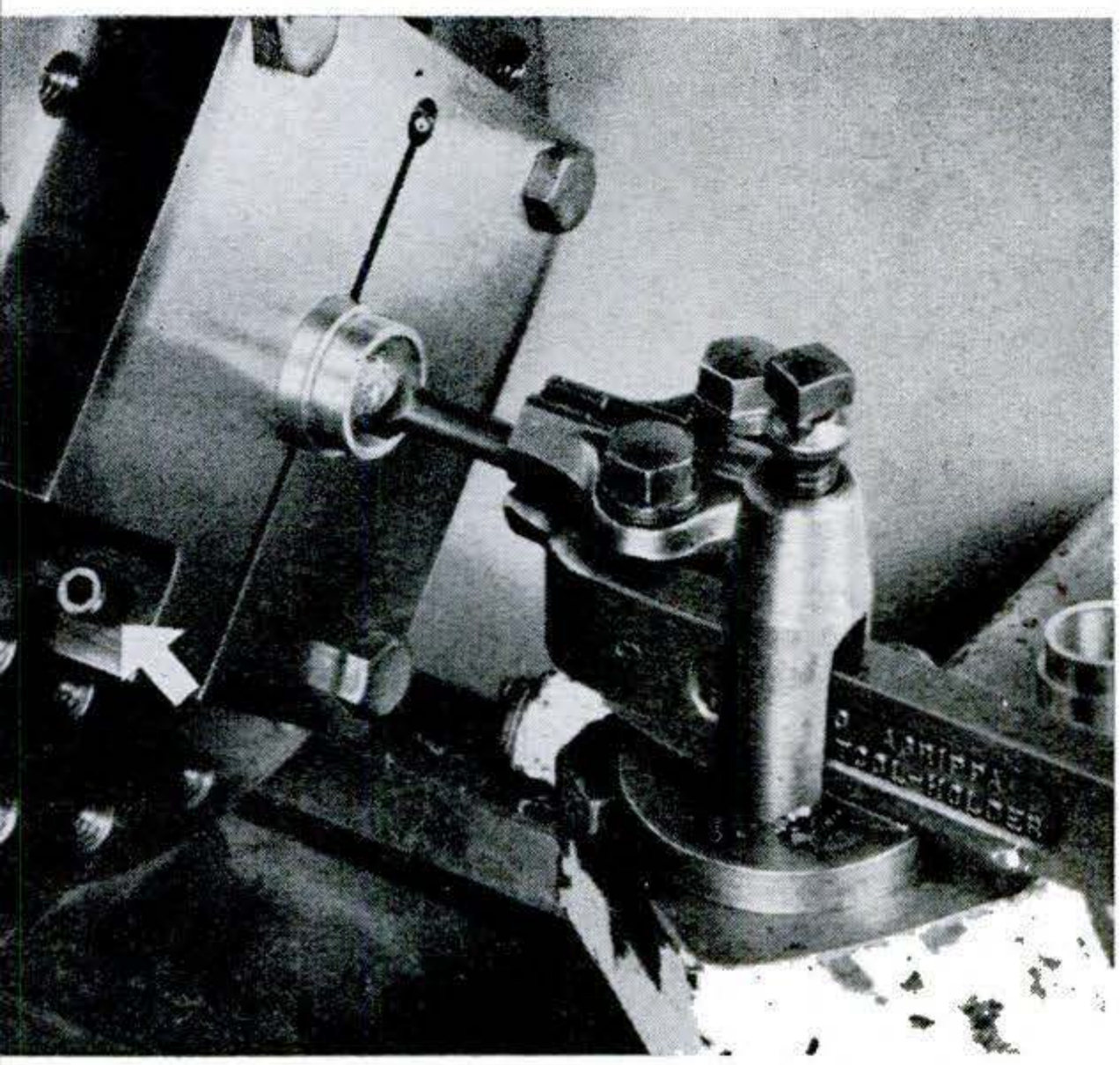


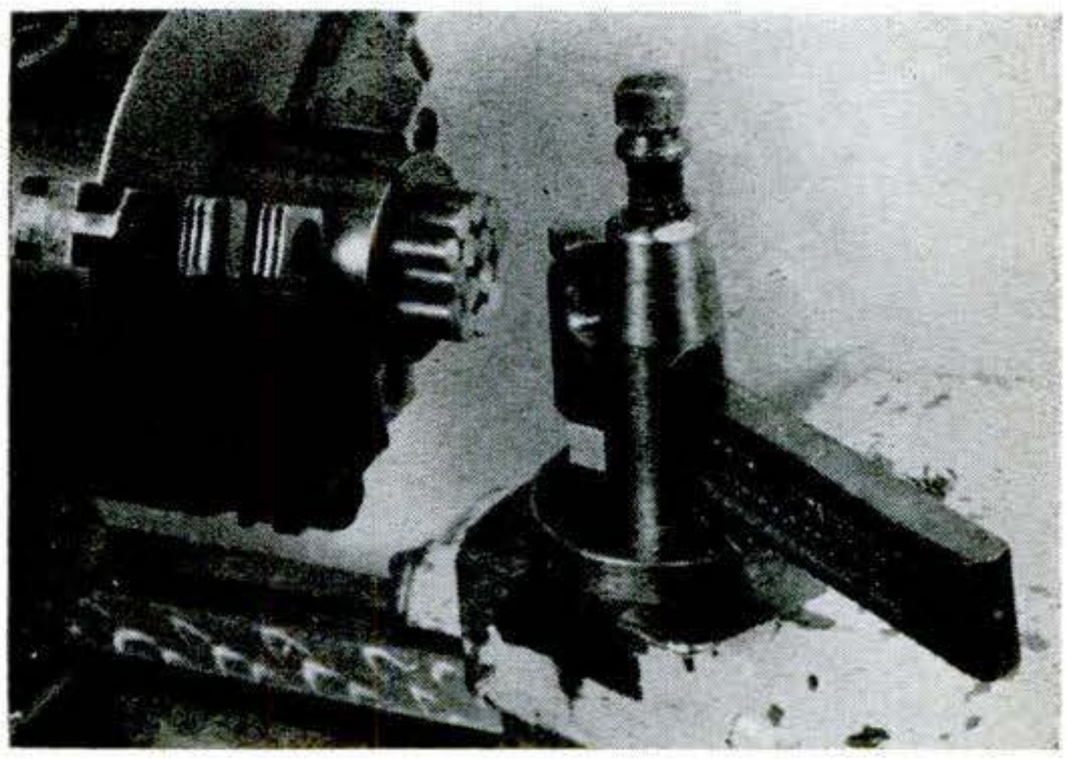
A sphere can be lathe-mounted by pulling it up tight against a ring of pipe or tubing. Chuck the ring with a center-drilled disk or backing plate behind it. Face the outer end of the ring and bore in about ½″ to true its inside diameter.

If the ball is hollow, drill and file a keyhole-shaped opening as shown. Insert the filed-down head of a bolt in the keyhole and twist it a half turn. Tighten the nut on the bolt with a socket extension inserted through the lathe spindle to draw the nut up tight against the backing plate behind the ring.

If the ball is solid, drill and tap a hole in it. Lock it to the ring with a machine screw in the backing plate tightened with a long screwdriver through the lathe spindle.

Any tendency to slip can be overcome by inserting strips of sandpaper between the ball and the ring.





Bundles of short rods can be faced in one operation almost as quickly as you could handle a single rod. Gang the rods together in a diagonally split sleeve, and tighten the chuck jaws on the sleeve to compress it over the rods. Face the entire bundle at a single pass.

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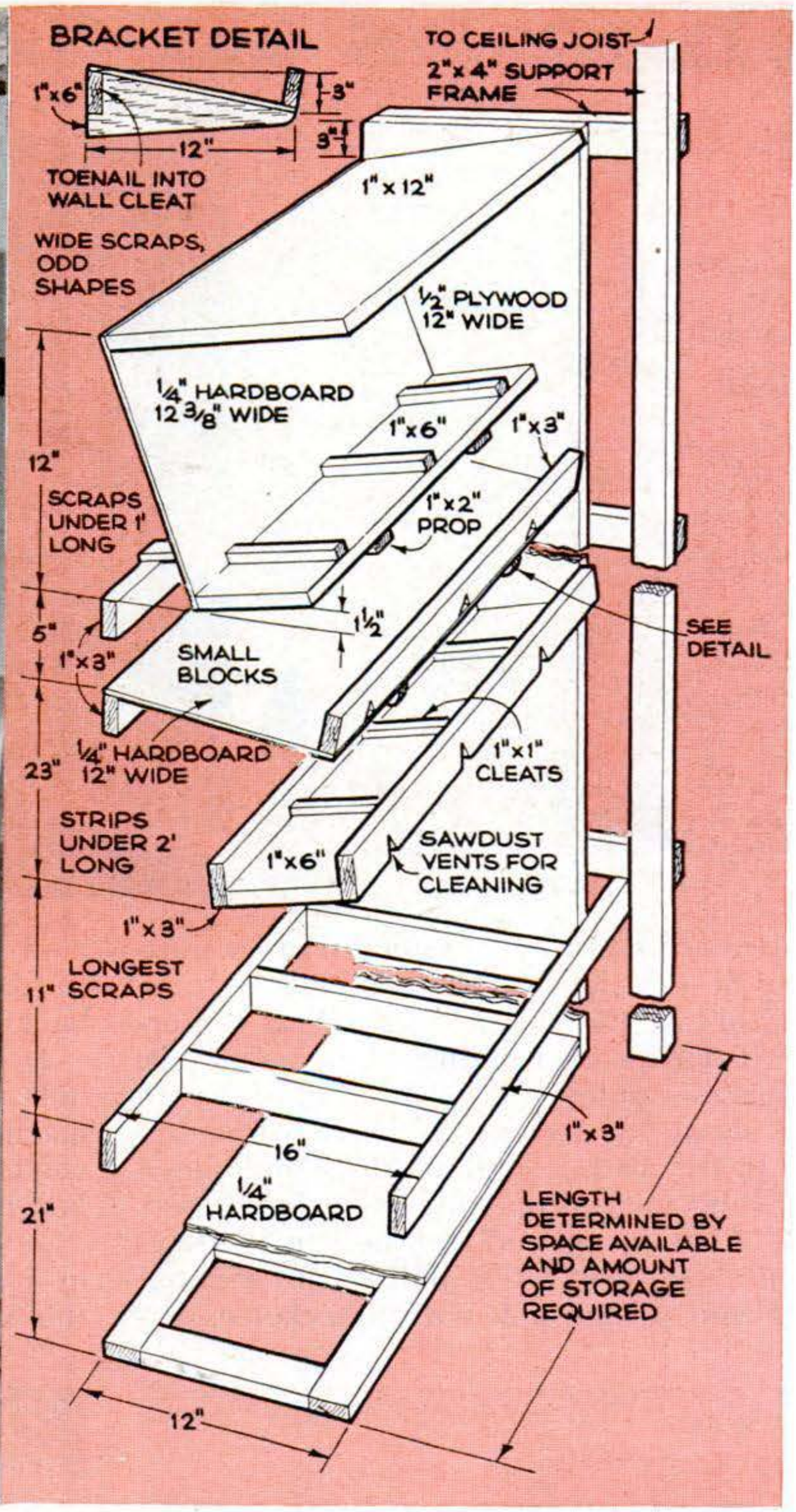

Storage Rack for Prized Wood Scraps

CAN'T bear to burn up precious wood remnants? And if you save them, what good is your treasure if you can't find a particular piece? The varied shelves of this rack help you file lumber and plywood scraps by size and species.

All shelves are tilted either up or down —at an incline of about 3″ per foot—to lean tall scraps back or keep small ones forward. If you can locate the rack in a corner, you'll need the supporting frame at only one end. Nail into each shelf through the plywood sidepiece.

The platform base keeps the ends of the longest pieces from absorbing moisture; it can be omitted if the floor is other than concrete. Finish off the job with two coats of penetrating sealer to protect the rack from wear and warpage.—*Edwin M. Love, Palmdale, Calif.*

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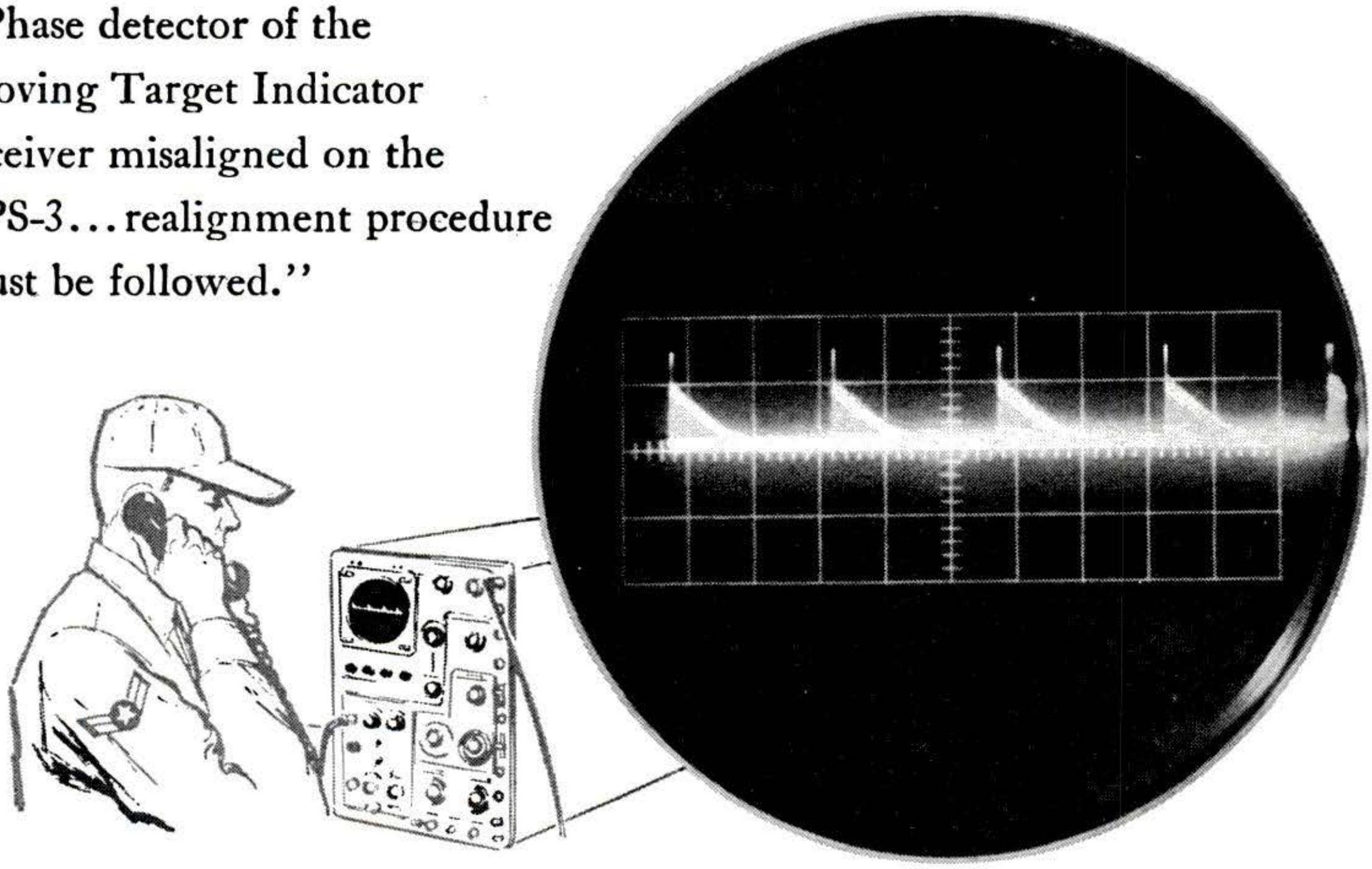
"Phase detector of the Moving Target Indicator receiver misaligned on the FPS-3... realignment procedure must be followed."



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New Ideas in Photography

Kodak Sound 8 Projector comes complete in built-in case with *f*/1.6 lens, speaker, microphone, and phono

Now you can add quality sound

Magnetic head of "Alfenol" alloy is almost wearproof, assures realism

Now you can get top-quality 8mm magnetic sound at half the cost of fine 16mm magnetic sound, thanks to a major advance in metallurgy.

The Navy has developed a new alloy called Alfenol: *Al* for aluminum, *fe* for iron, *nol* for Naval Ordnance Laboratory. Used in the new Kodak Sound 8 Projector, it provides fidelity rarely surpassed even in 16mm sound movies.

Gives long service

Alfenol is amazingly durable. While other recording heads need to be replaced after a few hours, the Alfenol head records for thousands of hours without any loss in sound quality.

The Kodak Sound 8 Projector makes it easy to add commentary, music, and sound effects to all your 8mm movies—old or new. Just ask your photo dealer to have Kodak Sonotrack Coating added to the edge of your edited film.

Comes with microphone

Then project your striped film at 16 or 24 frames, and record your commentary by speaking into the microphone that comes with the projector.

To add music or sound effects, connect your record player or tape recorder, using the phono connector cord. You can record, play back, and re-record until you are satisfied—as you would with a tape recorder.

When you hear the final playback, you'll be delighted with the clear, balanced tones produced by the built-in 10″ x 2″ oval speaker.

Judge the sound and picture quality of the

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connector cord. $345.

to 8mm movies!

Kodak Sound 8 Projector for yourself. $345 list, or as little as $34.50 down.

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Easiest low-cost way to show movies. Just feed the film into a slot and the show is on! Brownie 8 Movie Projector (Model A15) shows bright, sharp 8mm movies up to 4 feet wide. 200-foot reel capacity. $54.50.

Automatic Cameras' Tiny Power Plants Made of Selenium, Cadmium, Gold

Imagine subminiature power plants that use light as fuel! They are the keys to picture-perfect results with Kodak's new electric-eye cameras.

The power plants are photocells. Each is composed of a thin steel plate coated with layers of selenium, cadmium, and gold or platinum. The last layer is about one molecule thin, and is covered with lacquer to seal out moisture.

Light falling on the cell is converted directly into an electric current. The current is so small, it is measured in millionths of an ampere. Yet it

1) Brownie Starmatic Camera, $29.95; 2) Kodak Automatic 35 Camera, $89.50; 3) Brownie Automatic Movie Camera, *f*/2.3, $77.50; 4) Kodak Cine Automatic Turret Camera, *f*/1.9, $124.50.

can move the carefully balanced meter mechanism of any Kodak automatic camera (above).

The position of this mechanism determines your lens opening. In still cameras, the lens "squints" in sun, opens in shade when you press the shutter release. In movie cameras, the lens opening adjusts continuously.

These ultra-modern automatic cameras by Kodak make picture-taking easier and surer than ever before. See them at your dealer's.

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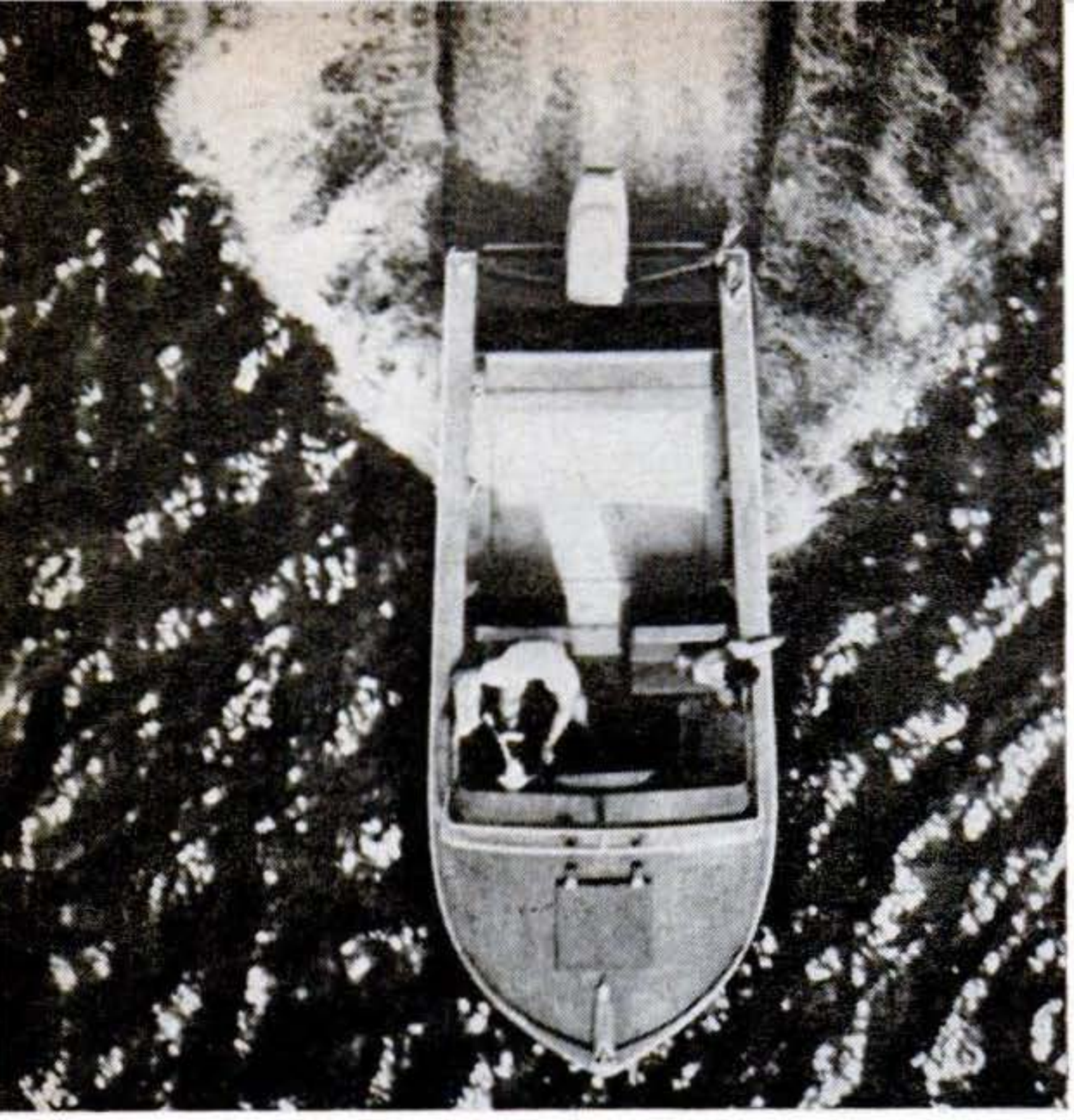
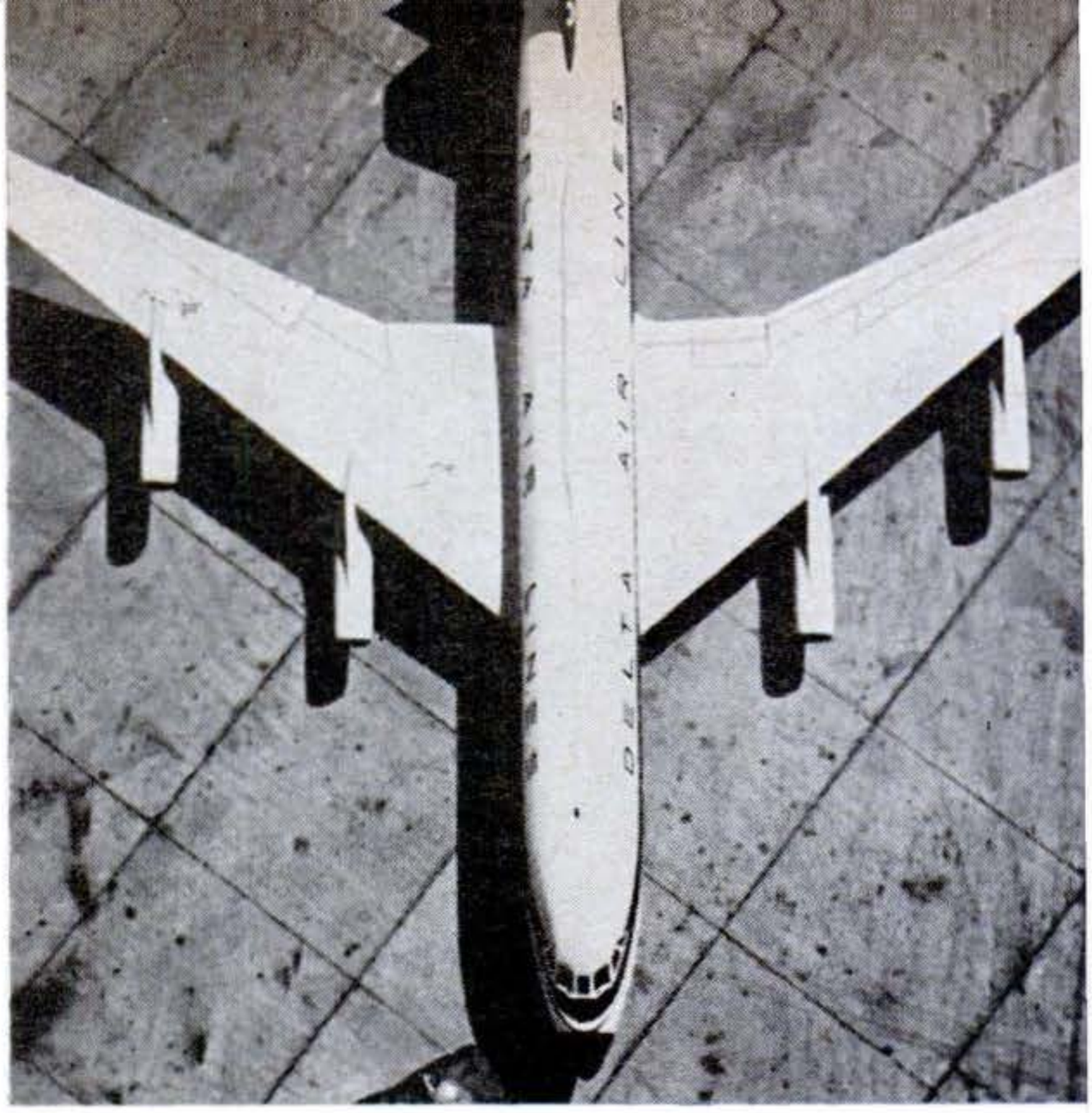
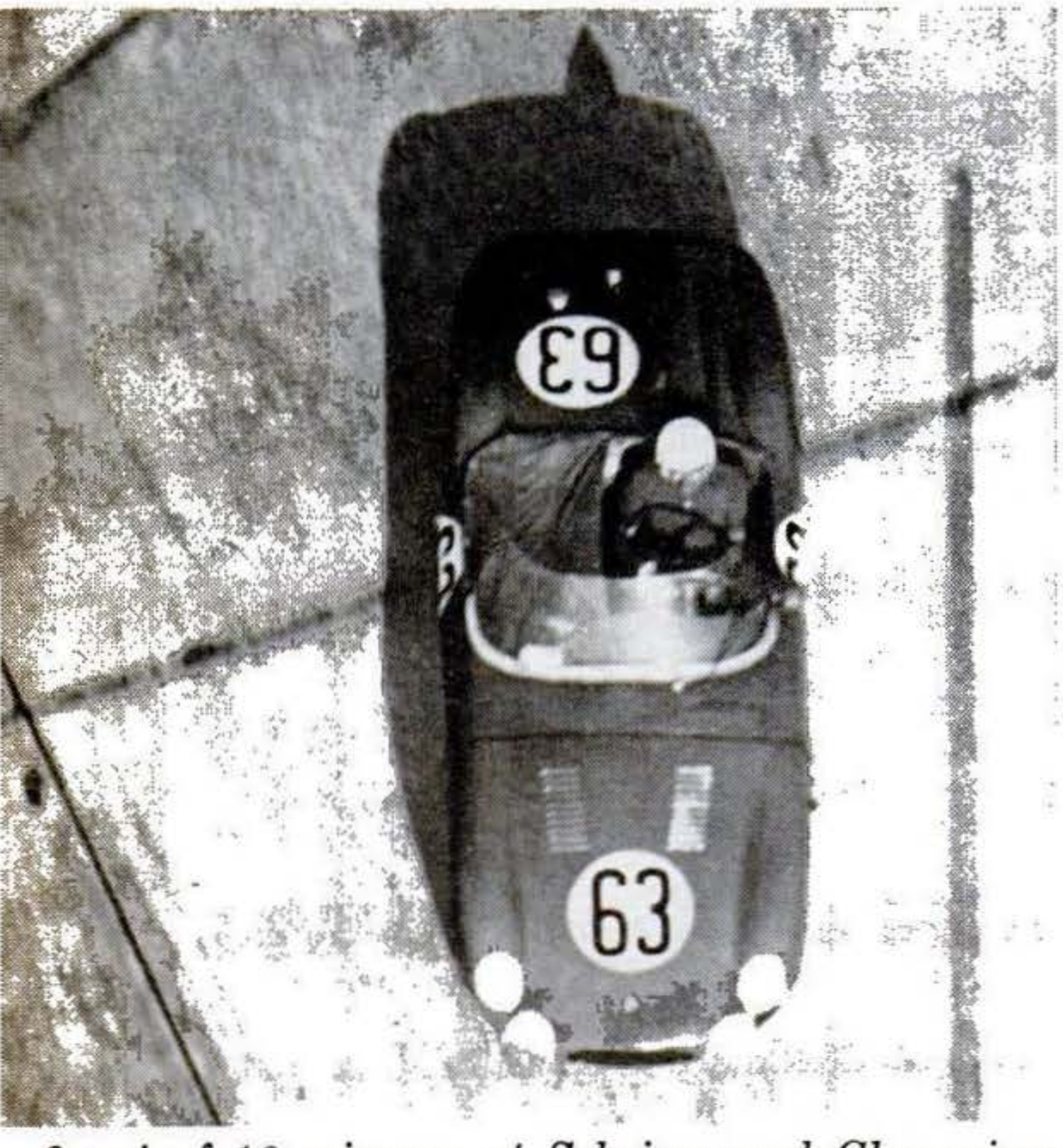


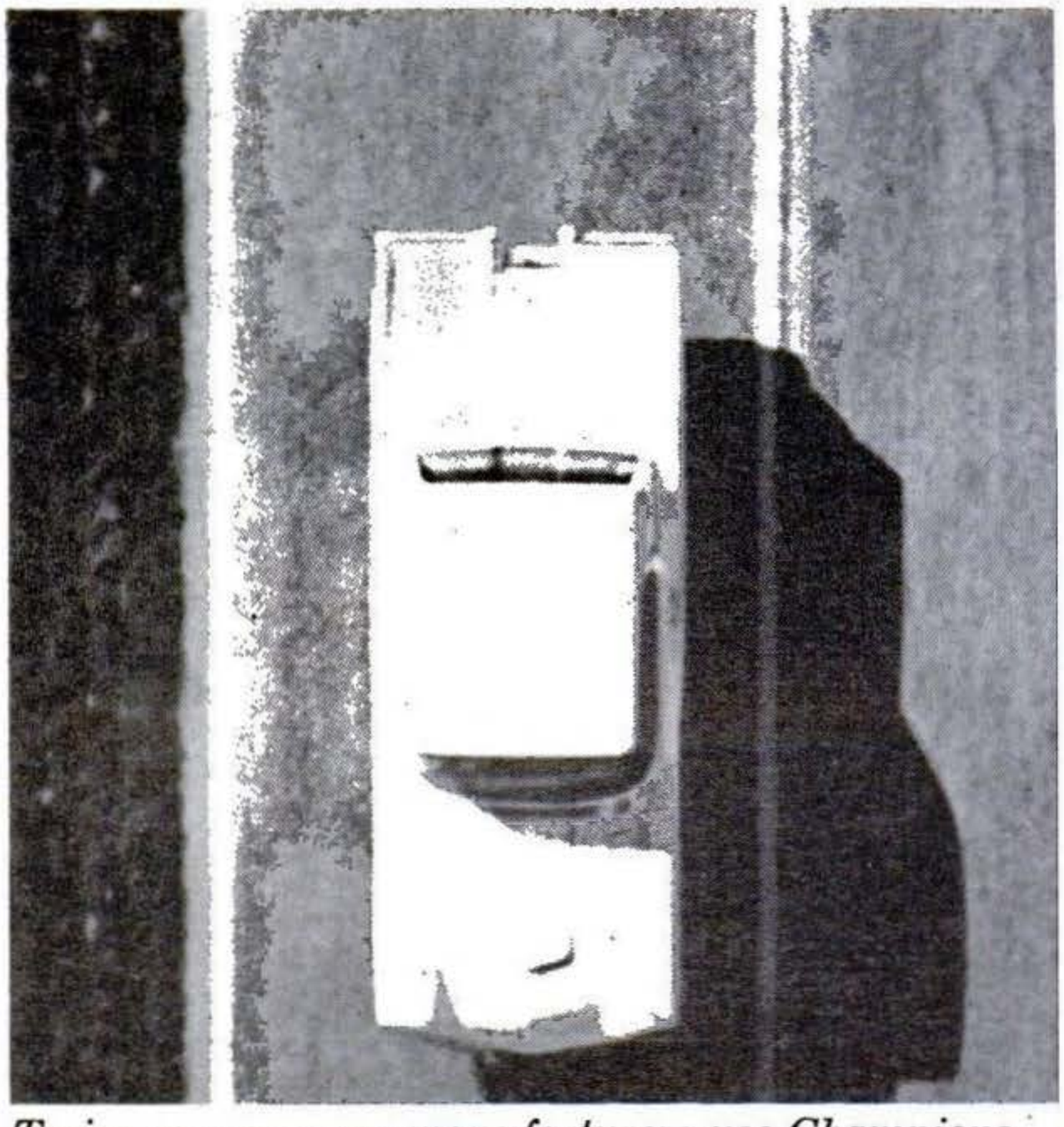
Every major U. S. outboard maker uses Champions



All U. S. jet engine manufacturers use Champions



6 out of 10 winners at Sebring used Champions



Twice as many car manufacturers use Champions

Q. Why do the experts, in field after field, where performance is vital, choose Champion spark plugs?

A. Because they know they can depend on Champions to deliver every bit of performance from every drop of gas. Your car will perform better, too (and save money on gasoline) with new Champions. Put in a set every 10,000 miles!

Worn spark plugs waste lots of gas—so check your plugs every 5,000 miles!

CHAMPION

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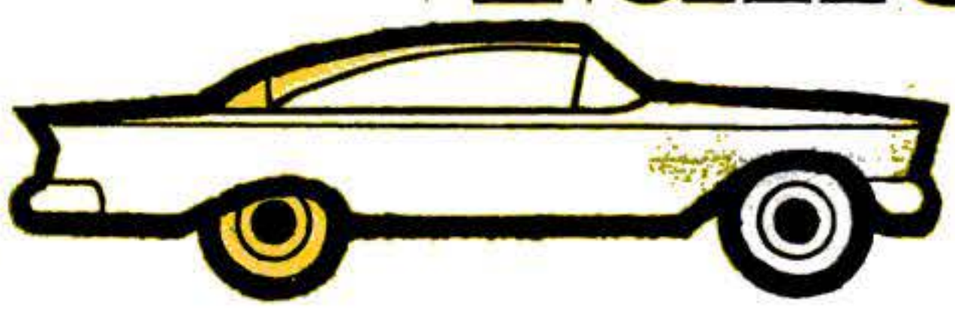
Tune-Up Quiz for Car Owners



Can you check off the correct diagnosis in each of these cases?

1 Spark plugs should be examined every time they are removed, for an indication of the motor condition. When the firing ends are covered with a dry, black, fluffy deposit, it may indicate:

A. excessive oil pumping; **B.** spark timing over-advanced; **C.** incomplete combustion.

2 Correct coil polarity, or the direction high-tension current flows through spark plugs, is important. Inadvertently reversing the polarity can often cause:

A. hard starting; **B.** pre-ignition; **C.** a short circuit.

3 Distributor breaker points and spark electrodes must be adjusted to the proper gap for a well-tuned engine. The gap should be checked with:

A. a flat feeler gauge; **B.** a round feeler gauge; **C.** a half-round feeler gauge.

4 Ignition timing should be checked and adjusted with a timing light. Before this is done, the:

A. air cleaner should be removed; **B.** spark plugs should be cleaned and gapped; **C.** breaker points should be gapped.

5 The carburetor is designed to deliver a correct fuel-air mixture to the engine under various driving conditions. This very precise mechanism requires:

A. periodic attention; **B.** very little attention; **C.** no attention.

6 The cooling system must disperse the excess heat developed by the engine. To do this efficiently, the coolant must be clean and should contain:

A. liquid radiator sealer; **B.** radiator cleaner; **C.** rust inhibitor.

7 The car battery has to do a big job. An item often overlooked, which helps the battery give better service, is:

A. cleaning the top of the battery regularly; **B.** adding new acid to the electrolyte once each year; **C.** running it down occasionally so it can be given a fresh charge.

8 The thermostat restricts water circulation to the radiator until the block temperature reaches the thermostat setting, to provide quicker warm-up and heater operation. During the hot summer months the thermostat is:

A. of no practical use; **B.** just as important as in winter; **C.** harmful to the engine.

9 The manifold heat-control valve is a thermostatically operated valve that diverts some of the hot exhaust gases to heat the intake manifold during the warm-up period. If this valve is inoperative and allows gases to exhaust directly at all times, it will:

A. waste fuel until the engine warms up; **B.** cause the fuel system to vapor-lock; **C.** result in burned exhaust valves.

10 Car engines have a breathing system to supply clean outside air to the crankcase for ventilation. Should this ventilation system become clogged and not supply air to the crankcase, it will:

A. cause the engine to overheat; **B.** prevent sufficient oil from reaching the cylinders; **C.** lead to excessive oil dilution and formation of sludge.

Now turn to the following pages to check your answers

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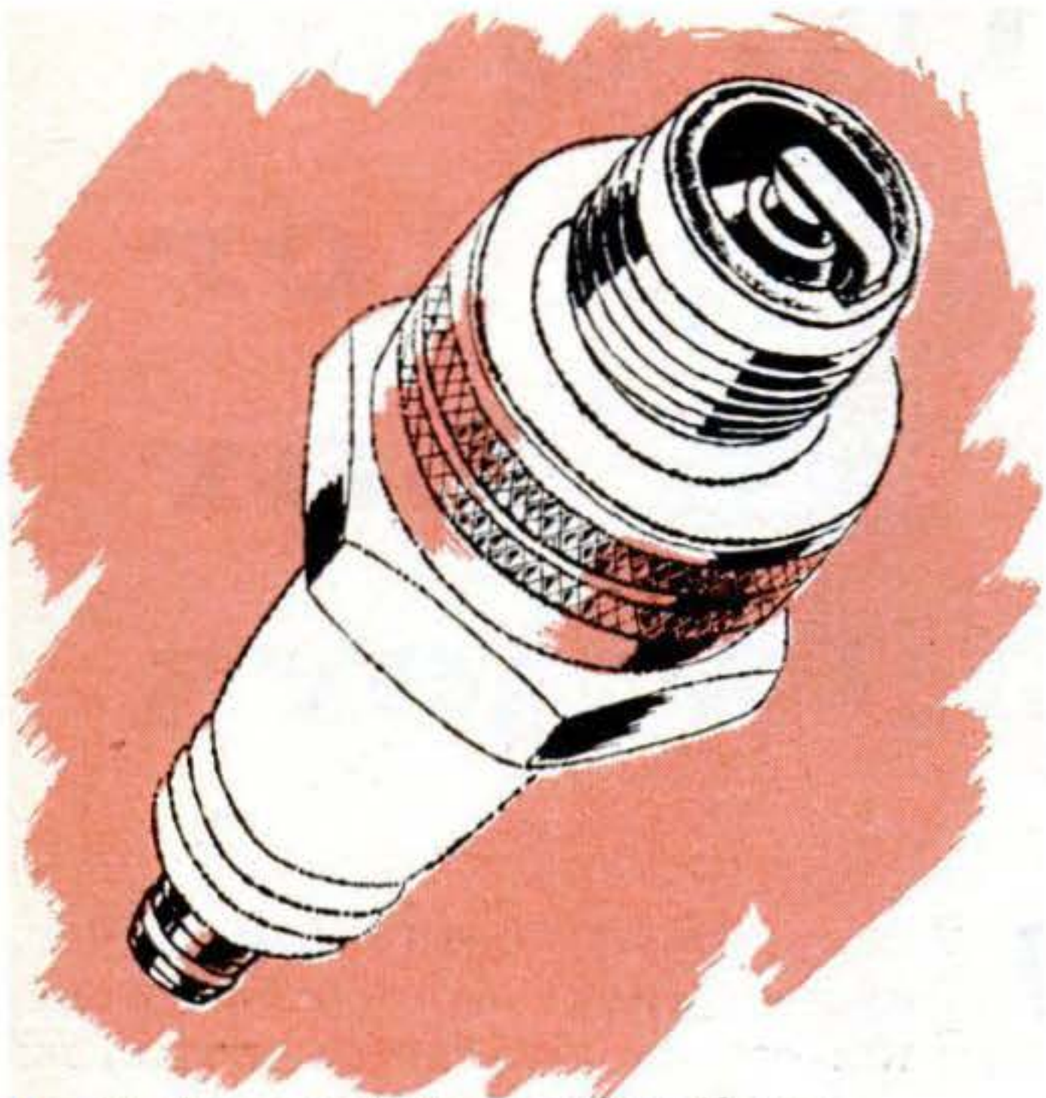
Judge your automotive I.Q. by the



1 C. incomplete combustion

A fuel mixture too rich to be completely burned is generally the cause of dry, black, fluffy deposits on spark plugs. Check for a dirty air cleaner that might be choking off air, a sticking or slow-opening choke, low-speed jets opened too far, or a too-high fuel level in the carburetor float bowl.

Correct air-fuel ratio is important to the life of your engine. Even a slightly over-rich fuel mixture can reduce by a third the mileage you get before the spark plugs must be cleaned. Many garages can analyze your air-fuel ratio and adjust the mixture for best mileage and operation.

If this deposit continues after you've made sure the engine is receiving the correct fuel mixture, hotter plugs may be needed. (Cold plugs may have been installed at some time, or your driving conditions may call for hotter-than-normal plugs.) Check your plugs against the recommended number for normal driving in your car, then buy the new plugs one or two numbers hotter.

Should only one or two plugs show this type of fouling condition, inspect the high-tension wires to these plugs for cracked or worn insulation; replace them if necessary. Sticking valves in one or more cylinders may also be the trouble makers. A little top-cylinder tune-up oil squirted into these cylinders or onto the valve stems may end the problem by freeing the valves.

2 A. hard starting

Coil polarity should always be negative at the spark-plug terminal. If polarity is reversed—usually by incorrectly connecting the primary leads—a decided increase in voltage will be required to fire the spark plug. This results in rough idling and missing, as well as hard starting. Polarity will also be reversed if the battery is installed with the wrong terminal grounded, but this seldom happens.

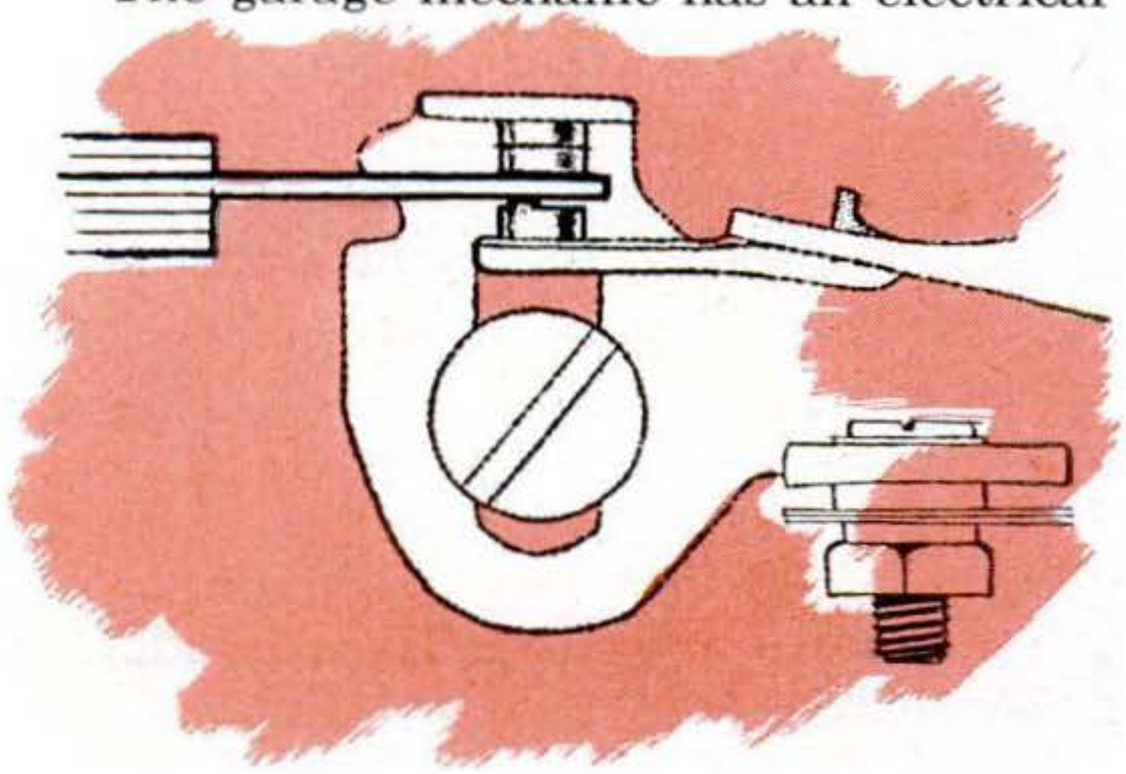
Polarity can be determined by a mechanic using a coil tester, a high-tension voltmeter, or one of the newer electronic ignition checkers. You can check with your eyes by examining the primary wiring connections. The thin wire running from the distributor to the coil (not the heavy high-tension wire) should be connected to the terminal on the coil that is marked the same as the grounded post of the battery. Thus, if the negative post of the battery is grounded, as most are today, then the distributor wire should be connected to the negative terminal on the coil.

3 B. a round feeler gauge

A round gauge is not only easier to use, but it will result in a more accurate setting of the gap.

After points and plugs have been in service for some time they show wear on their contact surfaces and electrodes. This uneven condition makes it almost impossible to set the gap with a flat gauge, which tends to contact only the high spots, resulting in a wider gap than intended. This decreases the point dwell and has the effect of advancing the timing, causing the engine to idle roughly and knock under load.

The garage mechanic has an electrical



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dwell meter to set points accurately, but the home mechanic must set them with a feeler gauge. By careful use of a round wire gauge, a very satisfactory job can be done. It will pass between the high spots and give a closer setting.

4 C. breaker points should be gapped

As an engine is used, the fiber rubbing block on the movable point arm slowly wears away from rubbing the distributor cam, resulting in a gradually diminishing point gap. This undersize gap tends to retard the timing. Widening the gap to its original setting according to the manufacturer's specifications nearly always restores the timing. Adjusting the timing, however, has no effect on the point gap.

Make sure the points are adjusted accurately before checking—and, if necessary, adjusting—the timing.

5 B. very little attention

The carburetor is designed to mix and deliver the correct air-fuel ratio to the engine under varying conditions. Left alone, it will do its job efficiently for many thousands of miles.

Many drivers tend to tinker with the carburetor at the first sign of rough operation. Unless trouble is definitely indicated in the carburetor, it should be left alone until other, more probable items, such as the ignition system, have been checked.

There are, however, a few things that can be serviced by the home mechanic. Clean the air filter, fuel filter, and sediment bulb in the fuel pump to keep dirt from entering the carburetor. The addition of a separate fuel filter at the gasline connection of the carburetor will further protect the small passages from dirt that might slip through the fuel-pump filter.

Parts of the carburetor that can be adjusted are the low-speed needles and the idle-speed adjustment screw. For different climatic conditions, the accelerator-pump linkage and the automatic choke on some carburetors can be adjusted for best seasonal performance.

A visual check into the carburetor throat while holding the choke valve

open can determine if the accelerator pump is operating. Move the throttle linkage by hand; with each opening of the throttle you should see a stream of gas squirt into the throat.

The fuel level can be checked visually, too. With the engine idling and the choke open wide, the high-speed nozzle in the center of each venturi should be dry. If you see gas coming from the high-speed nozzle at idling speed, the float level is too high and should be corrected.

6 C. rust inhibitor

The cooling system of an automobile must be kept clean and free from rust. Water alone in the radiator will lead to corrosion unless an inhibitor is added to prevent it. Always add some form of inhibitor to the fresh water after every refilling.

The better brands of permanent antifreeze contain a good inhibitor, which will effectively prevent the formation of rust for one season. After that the inhibitor becomes saturated and worn out, and can no longer neutralize acids to prevent rust in the cooling system. For this reason, you should use fresh antifreeze every fall. The antifreeze properties may still be good after a year, but the inhibitor will have exhausted itself and can't be renewed.

7 A. cleaning the top of the battery regularly

A steady trickle of stored energy is slowly lost through the dirty, damp accumulation on top of a battery. This dirt acts

[*Continued on page 234*]

Gus Makes a Confession

By Martin Bunn

GUS WILSON crossed the torn-up street in front of the Model Garage and walked down to where a construction gang was laying a new storm sewer. The racket from a big crane, an air compressor, jack hammers, and a back hoe rooting ahead of the pipe crew was deafening.

Through the din, the sound of a missing engine caught his ear. As a musician can pinpoint a single sour note in a symphony orchestra, Gus identified the offender as the crane. He was surprised, because it looked new.

A young man climbed down from the cab and greeted him. It was Bill Wiggins, trouble-shooter for Wisnewski's Construction Equipment.

"You don't look very happy," Gus said.

"I'm not," Wiggins said. "We sold that crane to the contractor a few weeks ago. Ever since, it's been acting up and he threatens to turn it back and sue for damages. If he does, I lose my job."

Gus made sympathetic sounds. He knew the job was important to Wiggins. He'd been in trouble on and off during his teens, and the Model Garage owner had straightened him out and interested him in auto mechanics. Joe Wisnewski had hired Wiggins on Gus's recommendation. Now, if he lost the job, Gus feared his old irresponsibility might turn up again.

"Look at that," Wiggins said as the crane went into action. It was giving the operator a hard time. He was trying to swing a giant section of concrete culvert pipe into position over a ditch. Each time he started to lift and swing, the engine missed and sputtered, the cable twitched, the boom teetered, and he had to set his hand brake and wait for the machine to calm down.

Gus noted that the exhaust bark was too mild to indicate that the engine was pulling hard. And when it was hitting, the sound was smooth enough to suggest

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"You better get another crane in," Gus said to Wisnewski. "This thing is dangerous."

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that the trouble was not poor compression.

"Checked the spark plugs?" he asked.

"Checked them!" Wiggins said. "Changed them four times yesterday. They keep getting fouled. I just put in a brand-new set . . ."

He was interrupted by the noon siren. Activity stopped. The crane operator, lunch box in hand, came over to have a word with young Wiggins.

"The way that crane is behaving, Bill, I'm afraid we may have an accident."

"We'll just have to take it easy, Mac," Wiggins said. "I've been over that engine half a dozen times. Valves, rings, compression, timing are perfect. It doesn't use enough oil to measure. The magneto is as hot as a firecracker. I've done the best I can."

"I know you have, Bill," said the crane operator. "It's not your fault."

"Yeah, but try and tell my boss that." Wiggins turned to Gus. "Will you take a look at it, Mr. Wilson? If you can't spot the trouble—well, I'll quit before Joe Wisnewski has a chance to fire me."

"Sure," Gus said, climbing into the cab. "No need to check the spark plugs since you just changed them."

HALF an hour later Gus had inspected the magneto for cracks in the distributor housing, flashover, bad condenser, intermittent ground, crossfire, and impulse-coupling performance. He could find nothing wrong.

"Here comes your boss," said the crane operator, biting into an apple as he climbed the cab. "He looks mad."

"I wouldn't work that crane," Gus warned.

"You keep out of this, Gus Wilson." It was Joe Wisnewski, and he *was* mad. He turned on Bill Wiggins. "If this rig lets us down, you're through—and I'll see that you don't get another job with any construction outfit in this state."

"That's not fair, Joe," Gus said.

"Fair?" Wisnewski roared. "I'm not interested in being fair. There's a cloudburst headed this way. If the contractor doesn't get the pipe in down to the diversion point in the next two hours, half the town will be flooded."

The crane operator hit the starter button. The engine kicked in and he gave a few tentative tugs at the controls. Slowly he lifted a section of pipe and lowered it into the ditch, where a crew guided it into position. A panting bulldozer followed up, shoving in dirt.

Three sections were in place. As the fourth one was being lifted, it happened. The crane engine missed, backfired, missed again. The operator dropped his load on the soft earth bank.

"You better get another crane in," Gus said to Wisnewski. "This thing is dangerous."

"Can't," said Wisnewski, looking worriedly at black clouds scudding in from the north. "This one's specially rigged. It'd take hours just to change over." He pointed at Bill Wiggins. "You're fired!"

"I quit," Wiggins said angrily.

"Take it easy, you two," Gus said. "It's got to be the spark plugs—only thing I didn't check. Got another set?"

"Sure." Wiggins pulled a box from a pocket. "I've been buying the darn things wholesale."

"Put 'em in."

"And make it snappy," said Wisnew-

PROUDLY the Smiths moved into their modern new beach house, the only one of its kind on that stretch of shore. Its flat sun-deck roof was a delight at first, but after a couple of weeks Mr. Smith marched grimly into a paint store.

Three hours later he had finished painting a facsimile of the beach surface on the flat roof. There was even a wavy line representing receding water lapping painted "sand."

"There!" he said to a neighbor who came up to see what was going on. "Maybe that will do it."

The visitor stared, sure that Smith had flipped his lid. But actually he had good reason for doing what he had with paint and brush.

...How Come?

ANSWER: Sea gulls, accustomed to dropping shellfish onto rocks to split them open, had found the flat roof equally effective. Their "bombings" were noisy, and the debris left over from their shore dinners was objectionable. Since the gulls knew better than to drop shellfish on the beach, the sand being too soft to break the shells, Smith's camouflage was intended to trick them into ignoring his roof.

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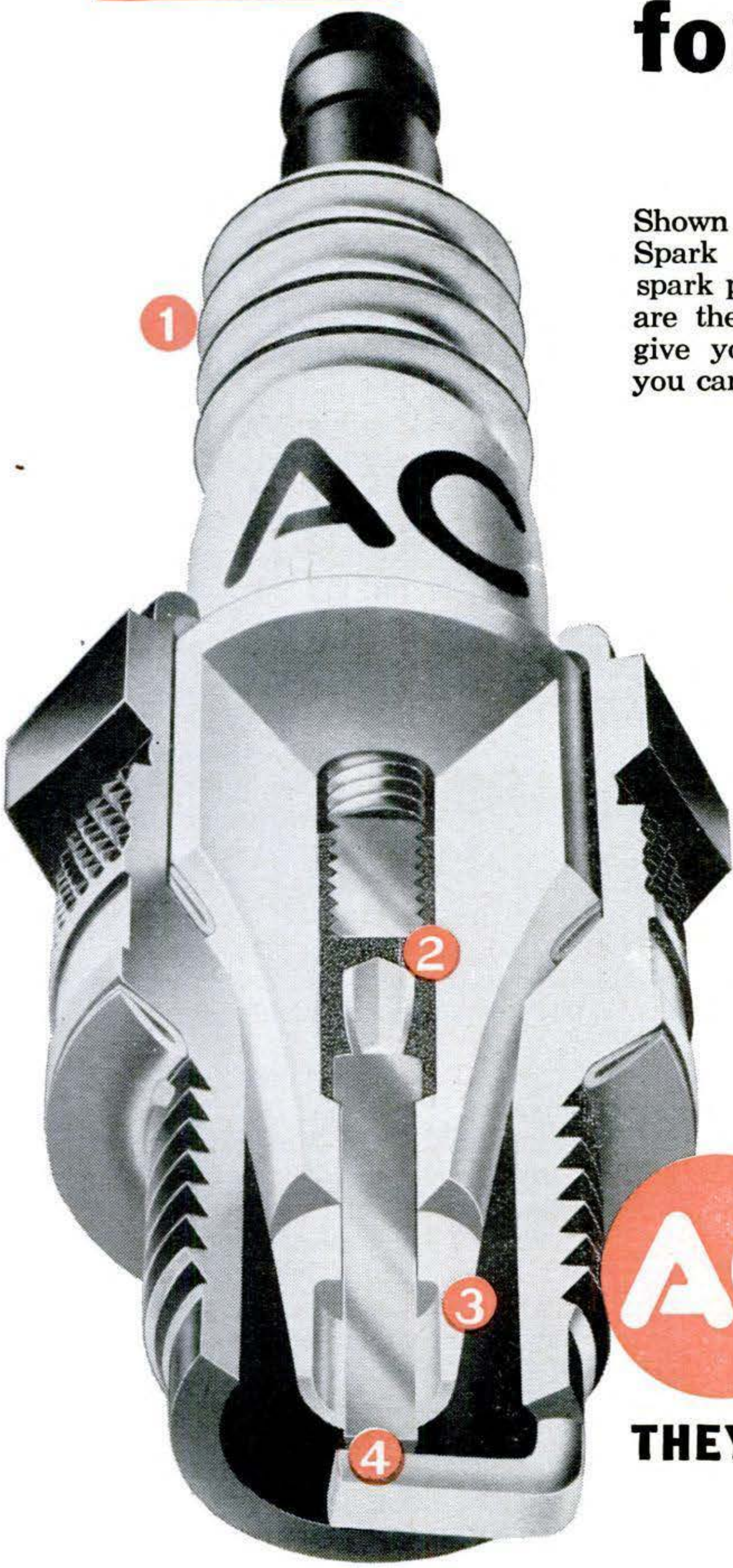
Here's why AC Spark Plugs ARE THE BEST for your car!



Shown here are four exclusive AC Fire-Ring Spark Plug features not found in any other spark plugs . . . four points of proof why ACs are the best . . . four reasons why ACs will give you the finest spark plug performance you can buy for your car.

1. **Buttress Top design** lengthens the flash-over path to provide sure firing under conditions of high humidity and extreme dirt deposits.
2. **Copper-Glass sealing** of inner structure prevents alteration of spark plug heat range and consequent spark plug and engine damage—assures smoother engine performance.
3. **Hot Tip Insulator,** long and thin, with deeply recessed tip, heats faster, cools faster to stay clean longer.
4. **Isovolt Alloy electrodes,** massive and thick, decrease electrode wear and resultant misfiring, for longer peak performance.

If your car has gone 10,000 miles or more since you last changed spark plugs, ask your dealer to install a set of new . . .

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THEY MUST BE THE BEST!

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ski, forgetting he'd just fired Wiggins.

Wiggins clambered up on the crane. He jerked out the plug cables without bothering to cut the mag. Gus was behind him, checking and spacing gaps as the young man's fingers spun out old spark plugs and put in new ones. When they were all in place, Wiggins started to unscrew brass extension terminals from the old plugs.

"No time for that," Gus said. "Just connect them up."

The crane operator started to protest. Wiggins ignored him, finished the job. "Okay, hit the button," he said, jumping down.

With a roar the engine came to life.

"Sorry, sir, but all cars must remain in the parking lot."

The crane lifted a section of pipe, positioned it smoothly in the ditch.

"Sounds good," Joe Wisnewski said.

Gus nodded. He was unscrewing the brass extension terminal from one of the spark plugs Wiggins had removed. Its purpose was to hold the wires farther away from the engine block to prevent heat from damaging the insulation. Examining it closely, he knew what had been the trouble and that a fluke had fixed it. The first drops of rain began to fall.

A FEW hours later, Joe Wisnewski and Bill Wiggins, both soaked to the skin, came into the Model Garage.

"We just made it," Wisnewski said. "If we hadn't, that contractor would have sued me for my shirt."

"Maybe," Gus said. "Why did you put these brass extensions on, Bill?" he asked, holding up one of the spark plugs that had been removed.

"The operator insisted on it," Wiggins said. "Told me he always used them on his old crane."

"Yes, but not with this type of plug," Gus said. "It's vented and needs a vented terminal."

"A vented spark plug?" Wiggins said, a puzzled look on his face. "Guess I haven't been doing my homework."

Wisnewski burst in. "The crane operator? Then it's the contractor's fault. I'll sue him for—for—" He calmed down. "What's a vented spark plug?"

Gus explained. Spark plugs on engines that idle a lot—as in a crane, police car, taxicab—often foul up because they don't get hot enough to burn away carbon that forms on the electrodes. A special plug, with an auxiliary spark gap inside, keeps the electrodes from losing heat. But the interior spark creates ozone, so the upper shank is hollow—vented—to let the ozone escape.

"If the ozone is trapped," Gus pointed out, "pressure builds up, making it hard for the spark to jump the gap. The result is misfire."

"Then this extension terminal trapped the ozone," Wiggins said. "It isn't bored through."

"That's right," Gus said. "A vented spark plug needs a vented terminal."

"Well, that's how we learn," Wisnewski said, smiling now. "Thanks, Gus. You saved our lives. Come on, Bill."

When they had gone, Stan Hicks eyed his boss suspiciously. "You were awfully smart about vented spark plugs."

Gus grinned. "I'll confess—but only to you, Stan. I didn't really spot the trouble till *after* we'd changed the plugs—without time to screw on the extensions. After I got back here, I confirmed it with this technical bulletin from the spark-plug people." He pulled some folded papers from his pocket. "While our friends were out in the rain, I was boning up."

Stan winked in mock conspiracy. "The secret's safe with me, Boss. Now what were you saying about a raise?"

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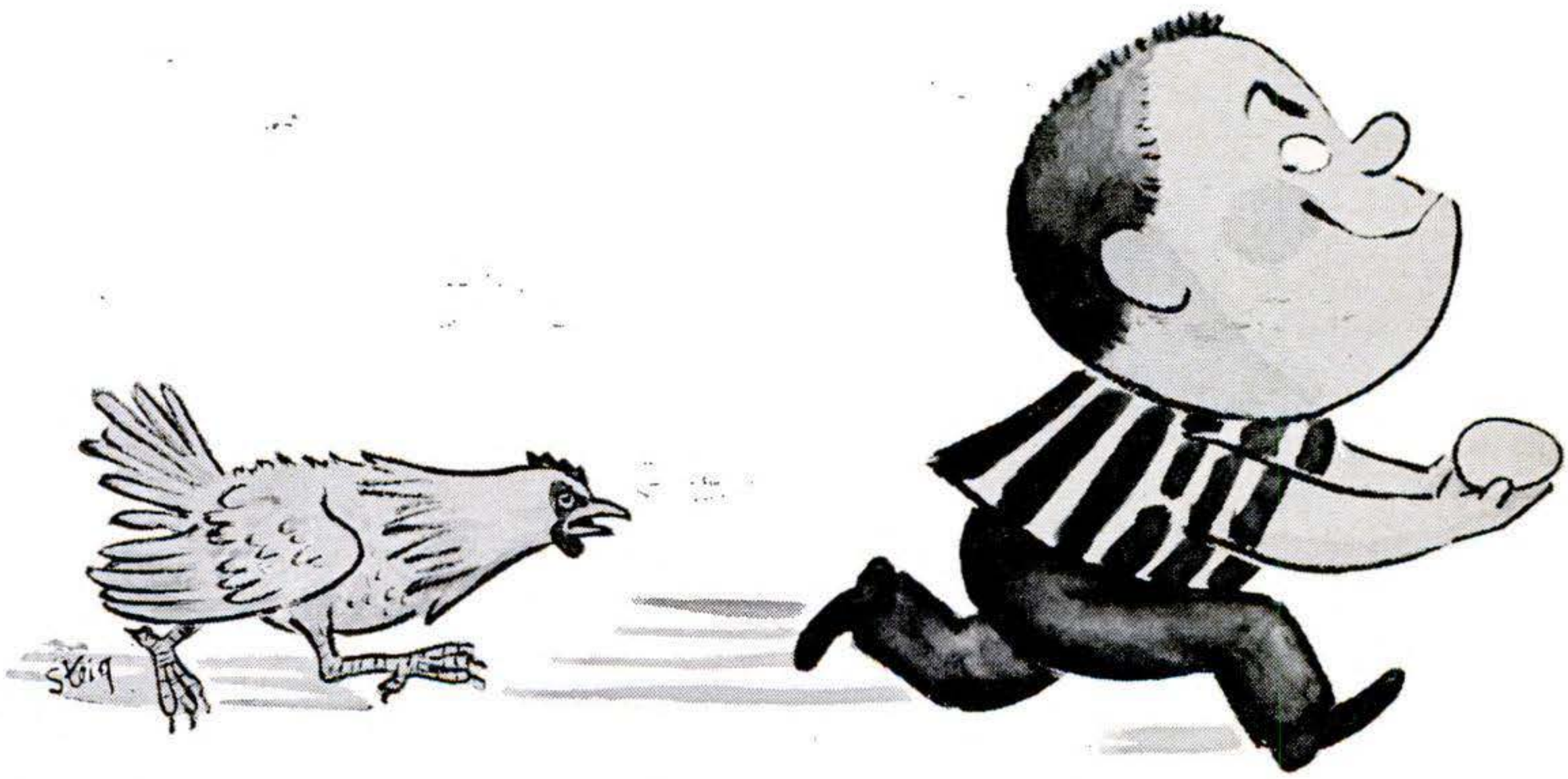
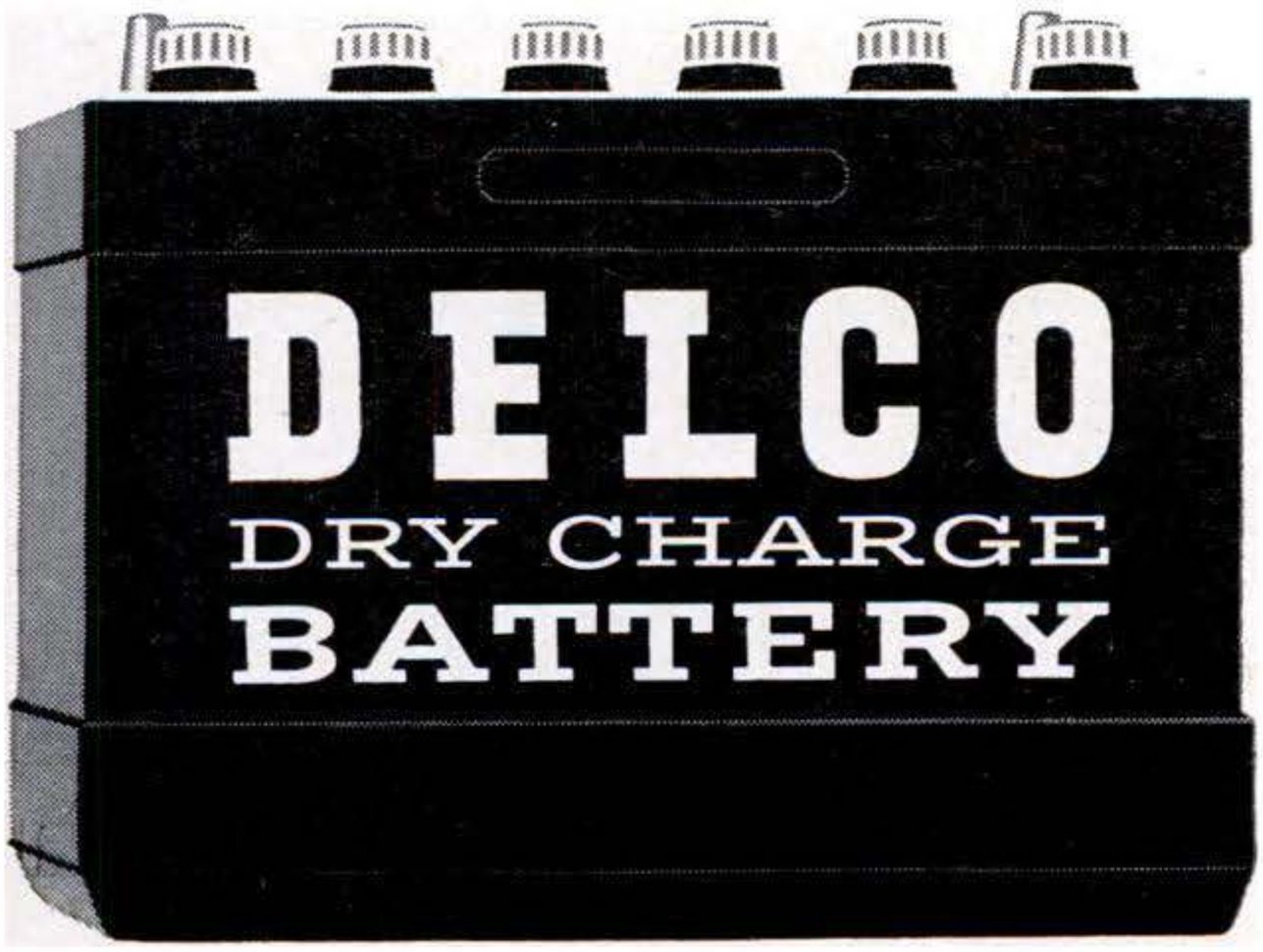
100% FRESH STARTS



There's just no substitute for a fast start when the occasion calls for it. (Ask any car owner!) And you *get* fast starts from a Delco Dry Charge battery—because a Delco DC is 100% FRESH. It's not activated until you buy it—so you get all the power you pay for. Better yet, you can count on a long life of dependable starts from this battery because it's specifically designed to handle the increased electrical needs of today's high compression engines.

Don't take a chance—ask your regular serviceman for a Delco DC-12, the battery built by Delco-Remy, world-famous manufacturer of a complete line of automotive electrical equipment.



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[Continued from page 227]

as an electrical conductor and allows current to escape. The steady loss, though small, can be measured with a sensitive meter.

The battery needs every boost it can get to help lighten the burden of the electrical demands made on it.

Sprinkle some baking soda on the top of the battery, and on the corrosion deposits on the cable ends, or dissolve baking soda in water and apply with a brush. Keep brushing and applying fresh soda until the foaming reaction stops. When it does, use fresh water to flush away the loosened deposits from the top and under the cable ends. Be careful not to get soda or solution in the air vent of the cell caps.

Allow the battery to dry, and coat cable ends and terminal posts with grease or petroleum jelly, making sure the connections are tight. Check the battery hold-down to see that it is tight enough to hold the battery firmly, but not so tight that it distorts or strains the case.

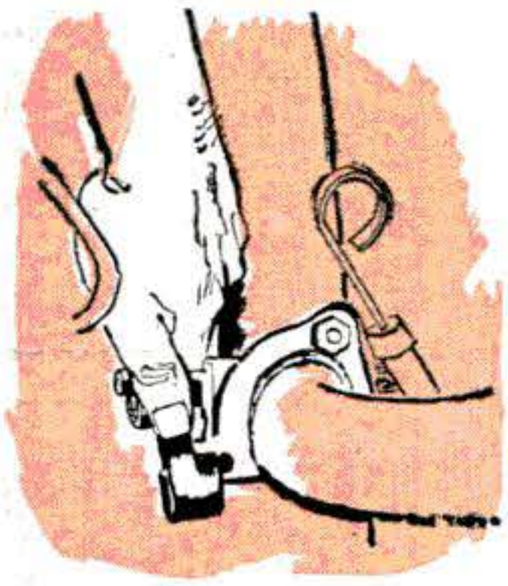
8 B. just as important as in winter

Never run your car without a thermostat. They come in various temperature settings. Choose one that fits your driving habits, and leave it in.

Some drivers remove the thermostat during hot summer months, which causes an increase in the time required for the engine to warm up to safe operating temperature. They're doing harm to the engine by encouraging the formation of sludge and acid.

9 A. waste fuel until the engine warms up

When the engine is cold—winter or summer—the manifold heat valve diverts exhaust gases to heat the outside of the intake manifold. This helps vaporize incoming fuel until the engine develops sufficient heat for efficient operation.



As the engine warms, a thermostatic spring expands and moves this internal valve or damper, eventually opening it completely to allow exhaust gases to go directly out.

If this valve is inoperative and allows the exhaust gases to go directly out without heating the intake manifold, much fuel is wasted at each cold start. The incoming fuel mixture, partly vaporized by the carburetor, condenses on the cold walls of the intake manifold, starving the engine and necessitating a richer setting on the automatic choke. Result is poor performance and poor economy as well.

Should this valve be stuck in the *closed* or warm position, it will heat the intake manifold excessively at all times. This can cause hard starting when the engine is hot; vapor lock, caused by excess heat, may boil the gasoline in the carburetor. It can also result in cutting out at high speed and, eventually, burned valves.

Move the counterweight on the heat valve occasionally to see that it is working freely. If it sticks, squirt penetrating oil on each end of its shaft to free it, then apply graphite to keep it working. If you can't free it, have the heat valve replaced.

10 C. lead to excessive oil dilution and formation of sludge

The crankcase ventilating system is very important. If it becomes clogged the engine cannot get rid of crankcase vapor, which contains moisture and acid. When this vapor condenses, it dilutes and contaminates the oil. This causes sludge, resulting in clogged oil lines and premature breakdown of engine parts through acid corrosion.

Two main parts of the system are a combination oil-filler-breather cap above the engine and a breather tube that extends below the crankcase. When the car is moving, the air stream creates a partial vacuum in the lower tube and air is drawn in through the breather cap. After circulating, the air is vented out the lower tube.

Clean the filter element in the breather cap by sloshing it in kerosene or solvent. Blow dry and re-oil. See that the lower tube is open and not crimped or bent (it points straight down). If it is equipped with a filter, remove it and clean it, following the same procedure as with the breather cap.

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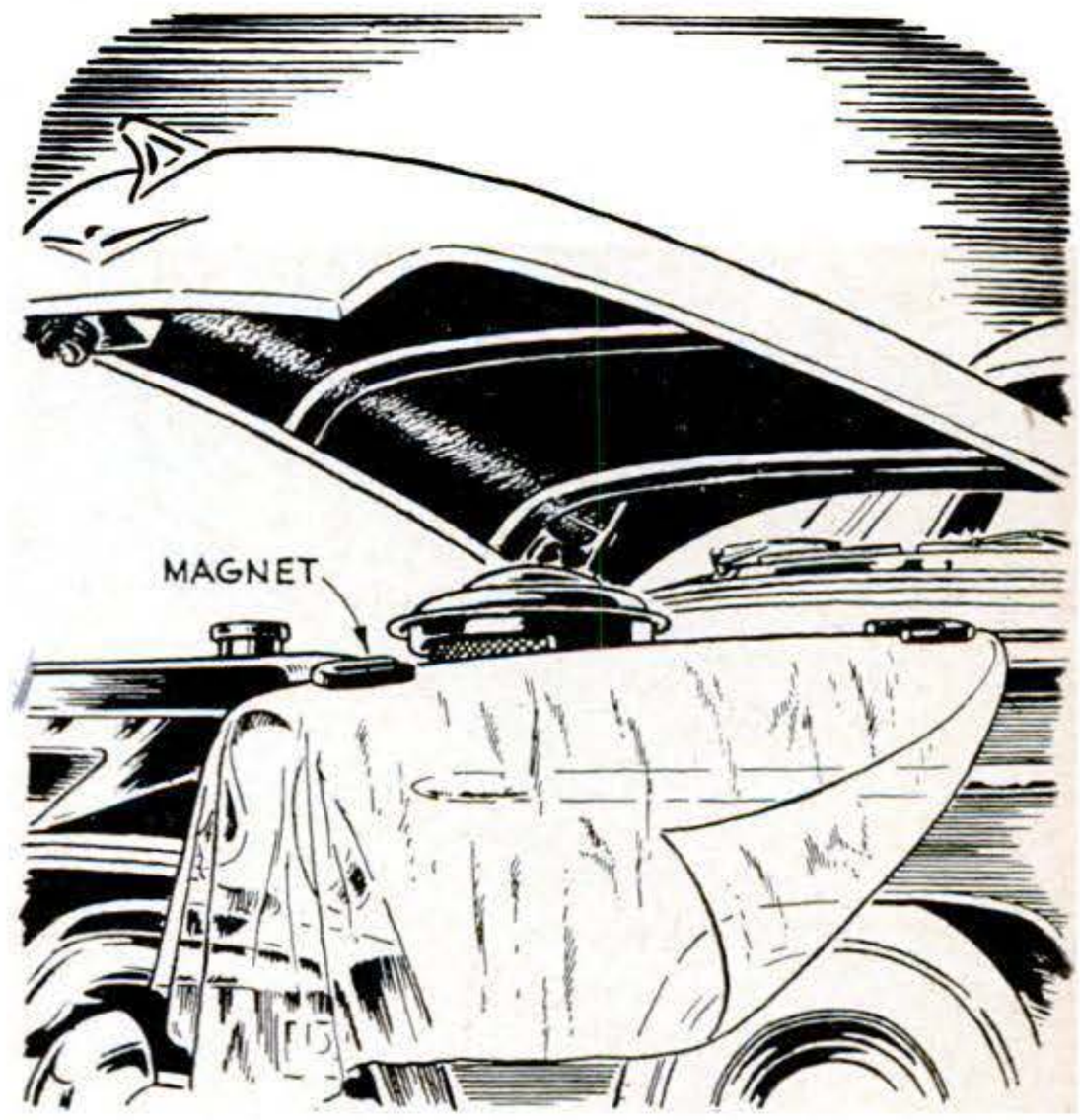
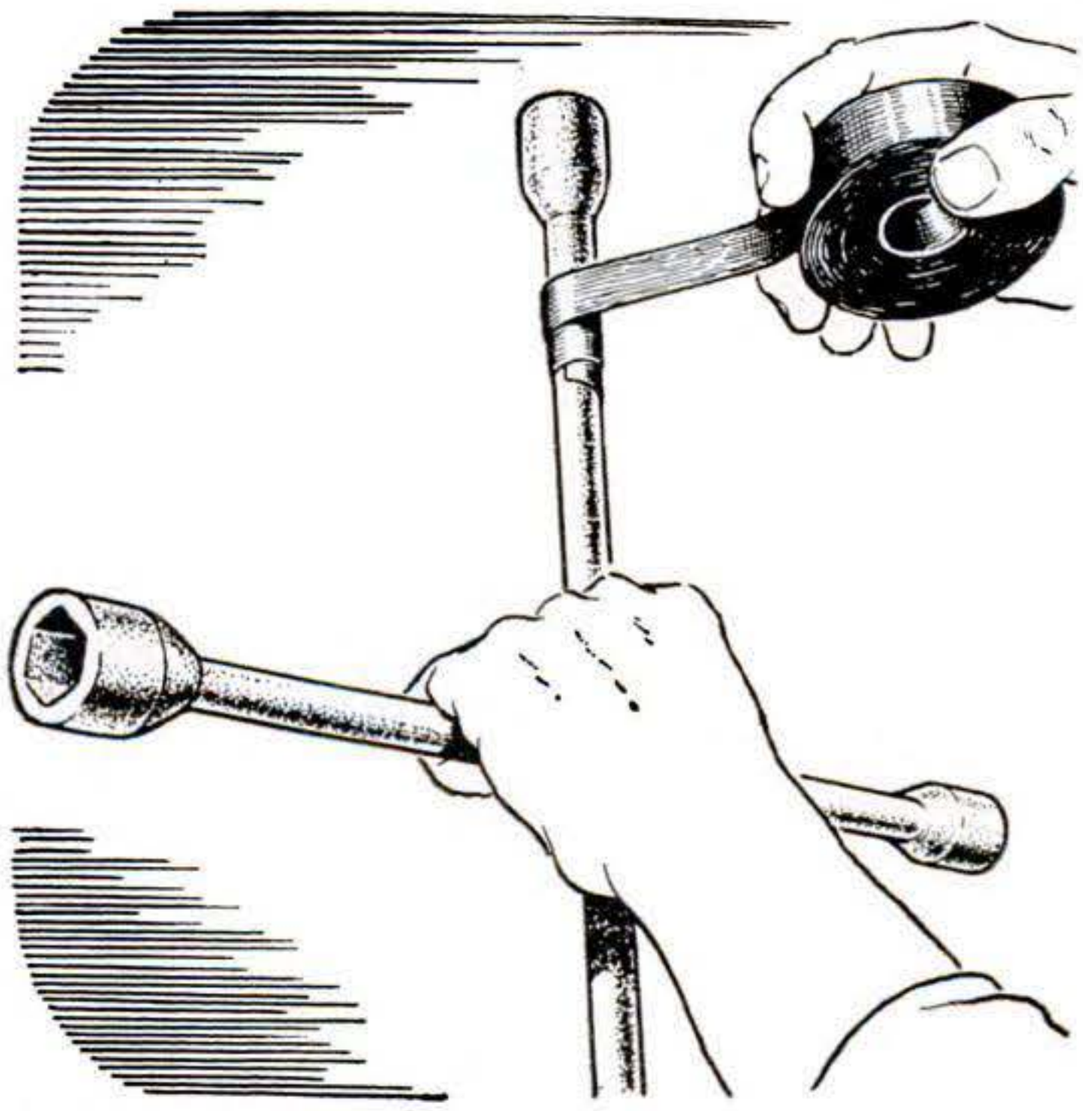
Hints from the Model Garage

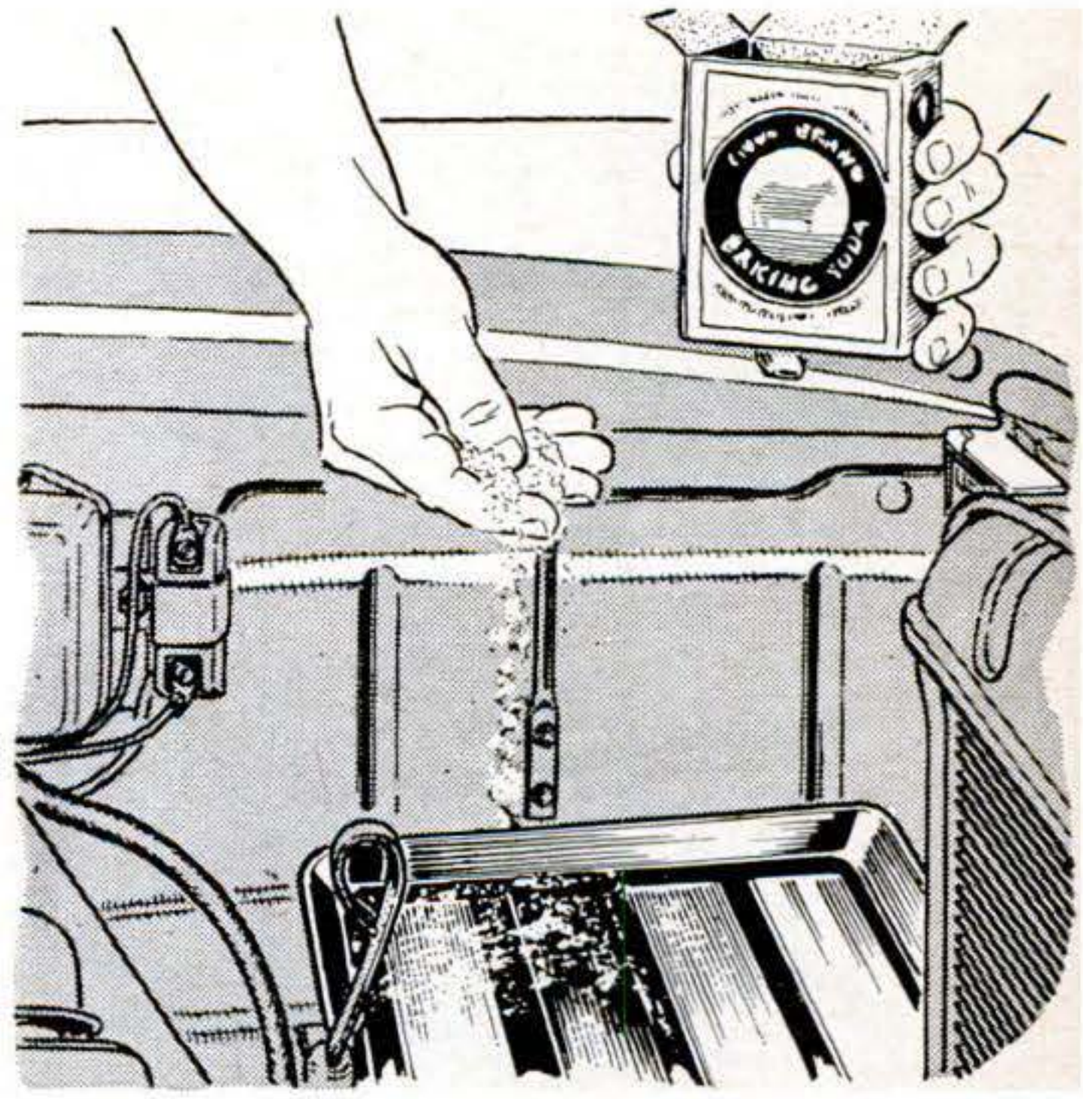
Here's a rope trick to simplify the installation of windows set in rubber molding. Place a heavy cord in the molding groove, press the window into position, and pull on the cord. The cord lifts the lip of the molding over the glass.



To protect your car's finish when working on the engine, drape a square of thin plastic sheet over the fender. The plastic is easy to wipe clean and folds into a tiny package for storing. Magnets make good nonslip hold-downs.



A four-way lug wrench is seldom used for anything but emergencies—often at night. Instead of painting the arm that fits the lug bolts of your car, as many people do, wrap it with tape that can be readily felt in the dark.



When installing a new battery, or one that's been out for a charge, brush out the metal tray of the battery holder and sprinkle some baking soda over it. The soda will neutralize any acid overflow and keep the tray from rusting.

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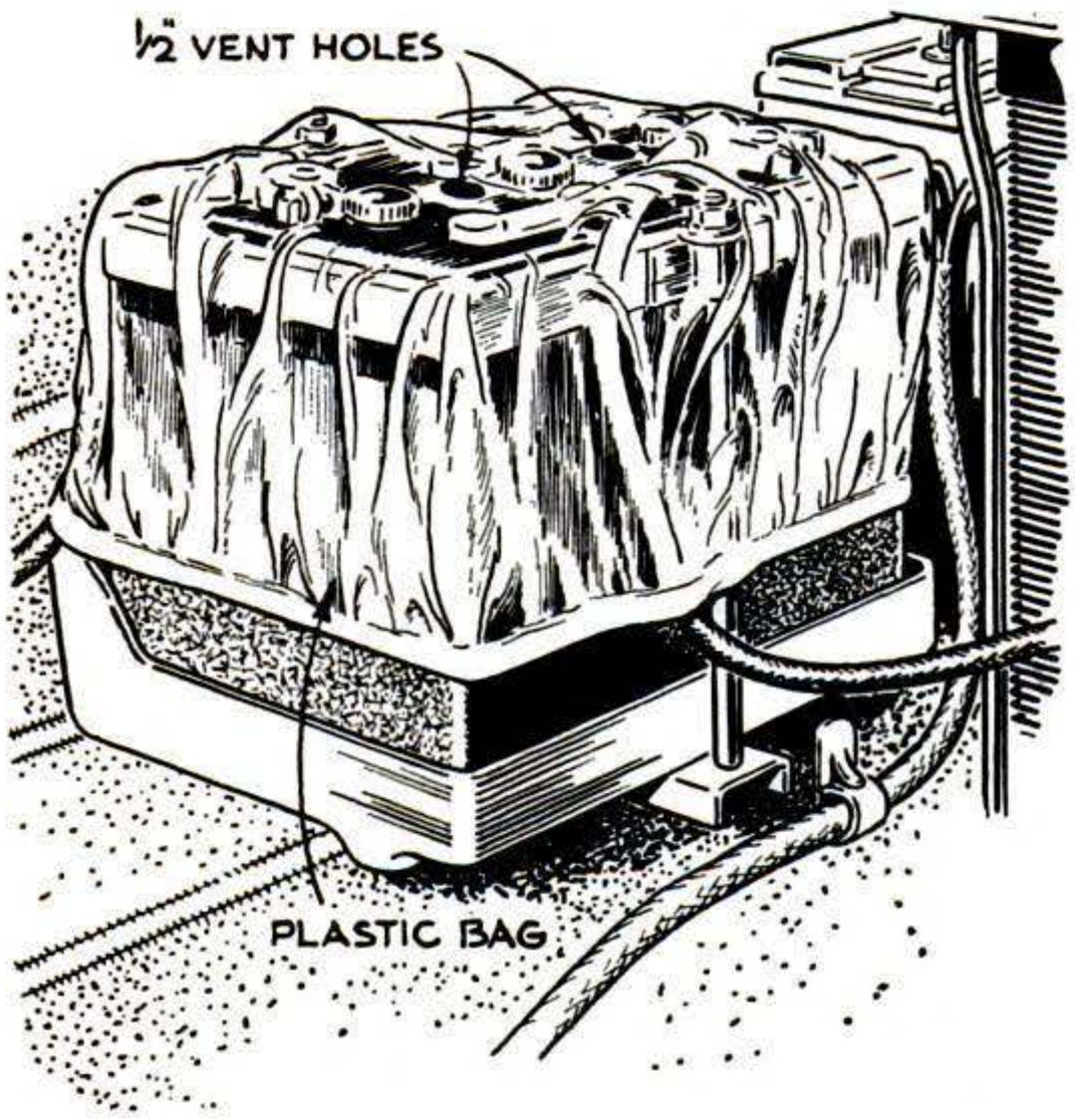
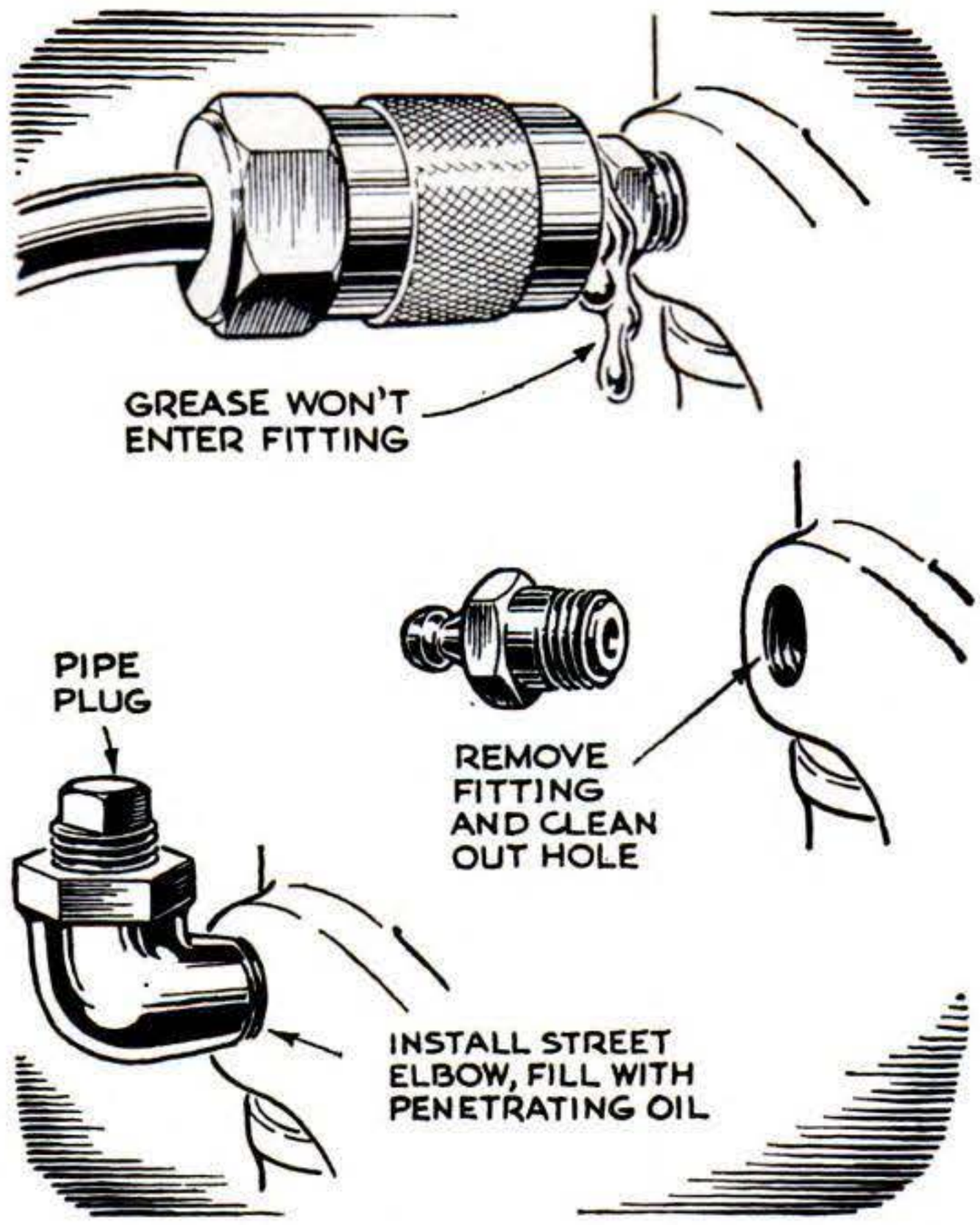
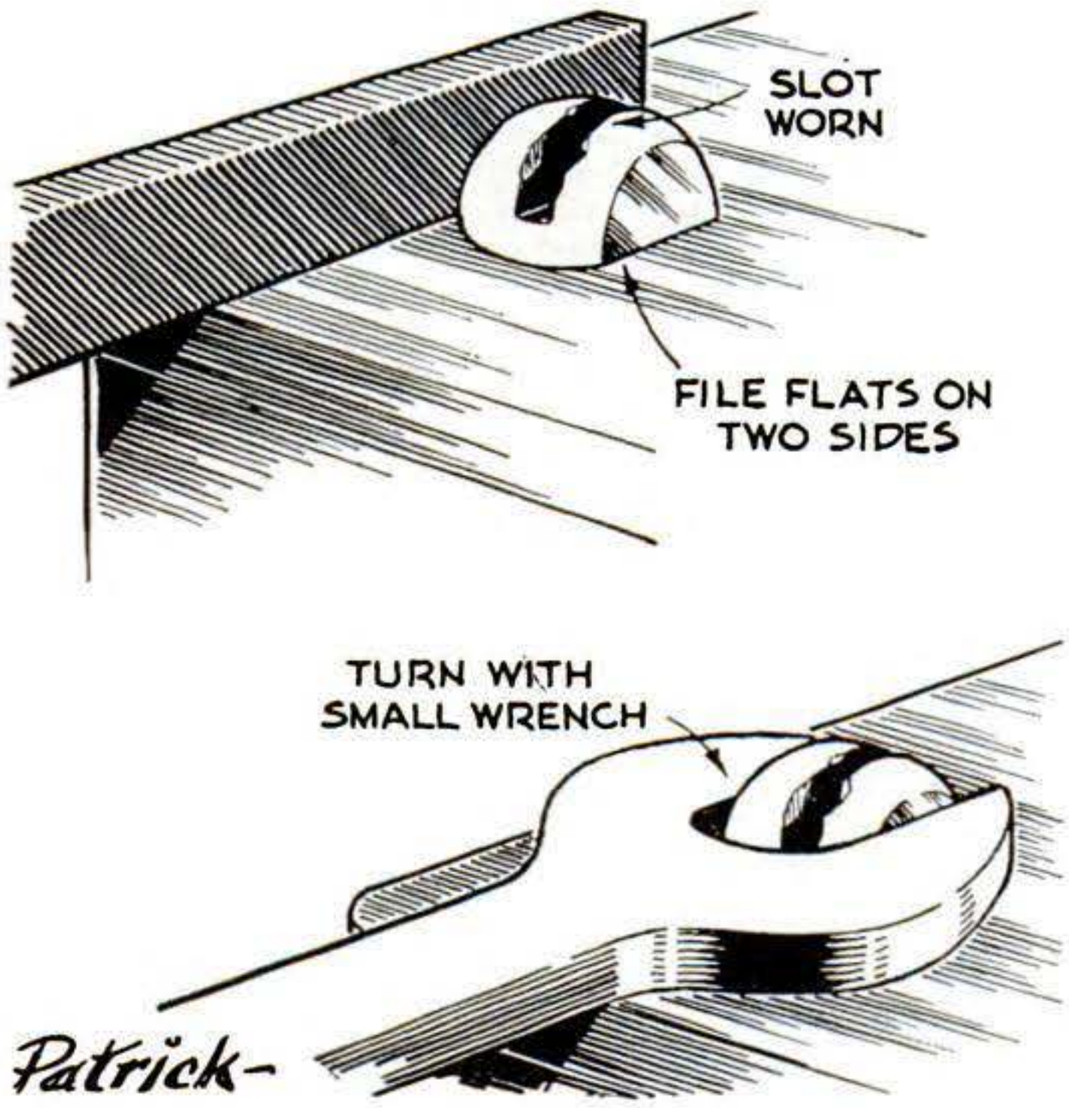
More Hints from the Model Garage



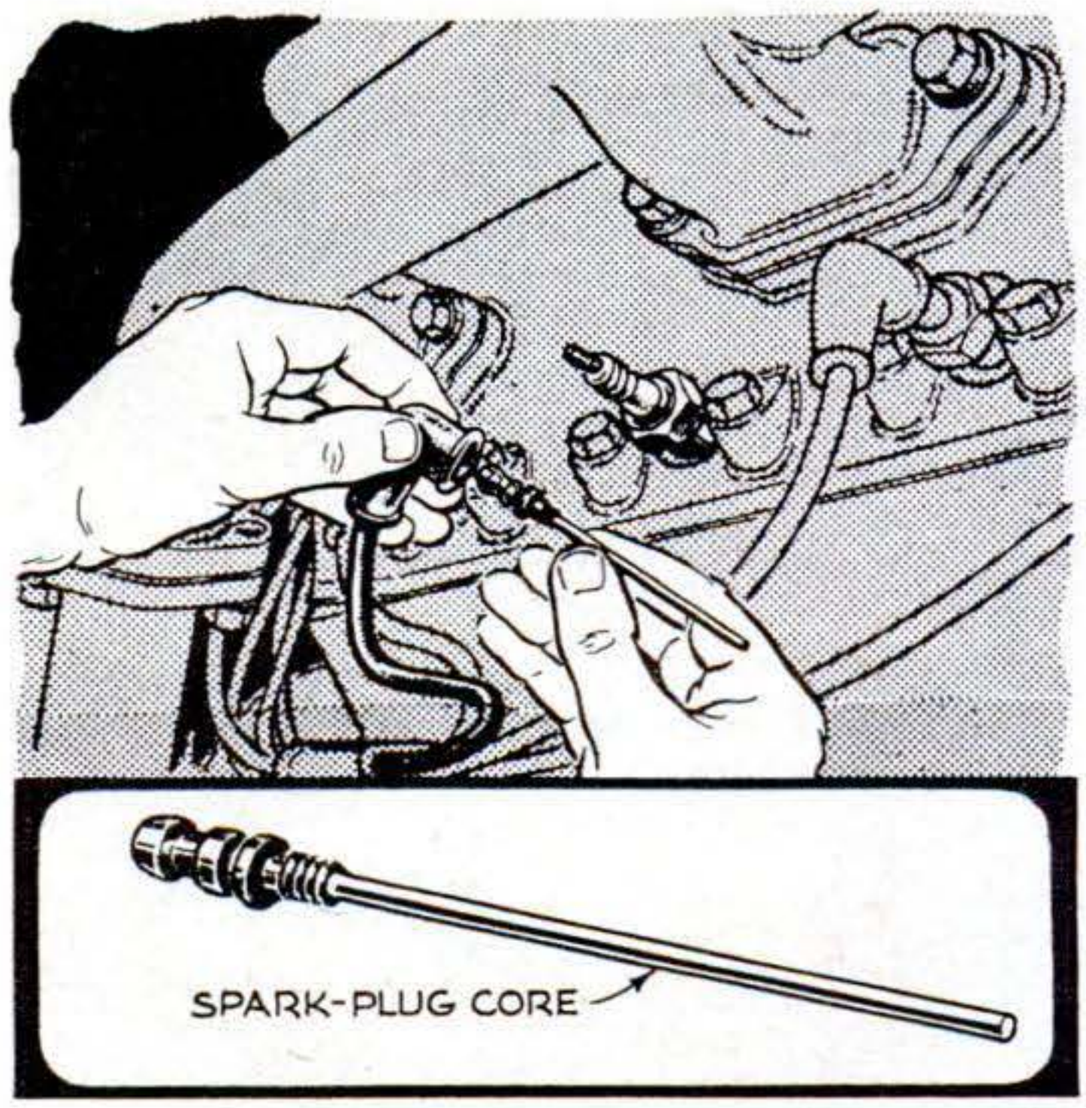
Protect the top of your battery from dirt and short-circuiting moisture, and cut down excessive evaporation of the electrolyte this way: Cover it with a plastic freezer bag. Cut two holes in the bag to vent off charging gases.



To clear a clogged grease channel, replace the fitting with a street elbow, fill the elbow with penetrating oil, and drive for a week. Put back the fitting and try your grease gun. Fresh grease should now force the old grease out.



A stubborn roundhead screw that resists removal because it's frozen or its slot is chewed beyond use can be unstuck by filing flats on opposite sides of the head. Then you can use a wrench on the flats to turn the screw with ease.



A spark tester, handy to use when spark terminals are sheathed in rubber, is easy to make this way: Break an old spark plug apart and save the core. The cap will snap easily into the wire terminal, leaving the core exposed for testing.

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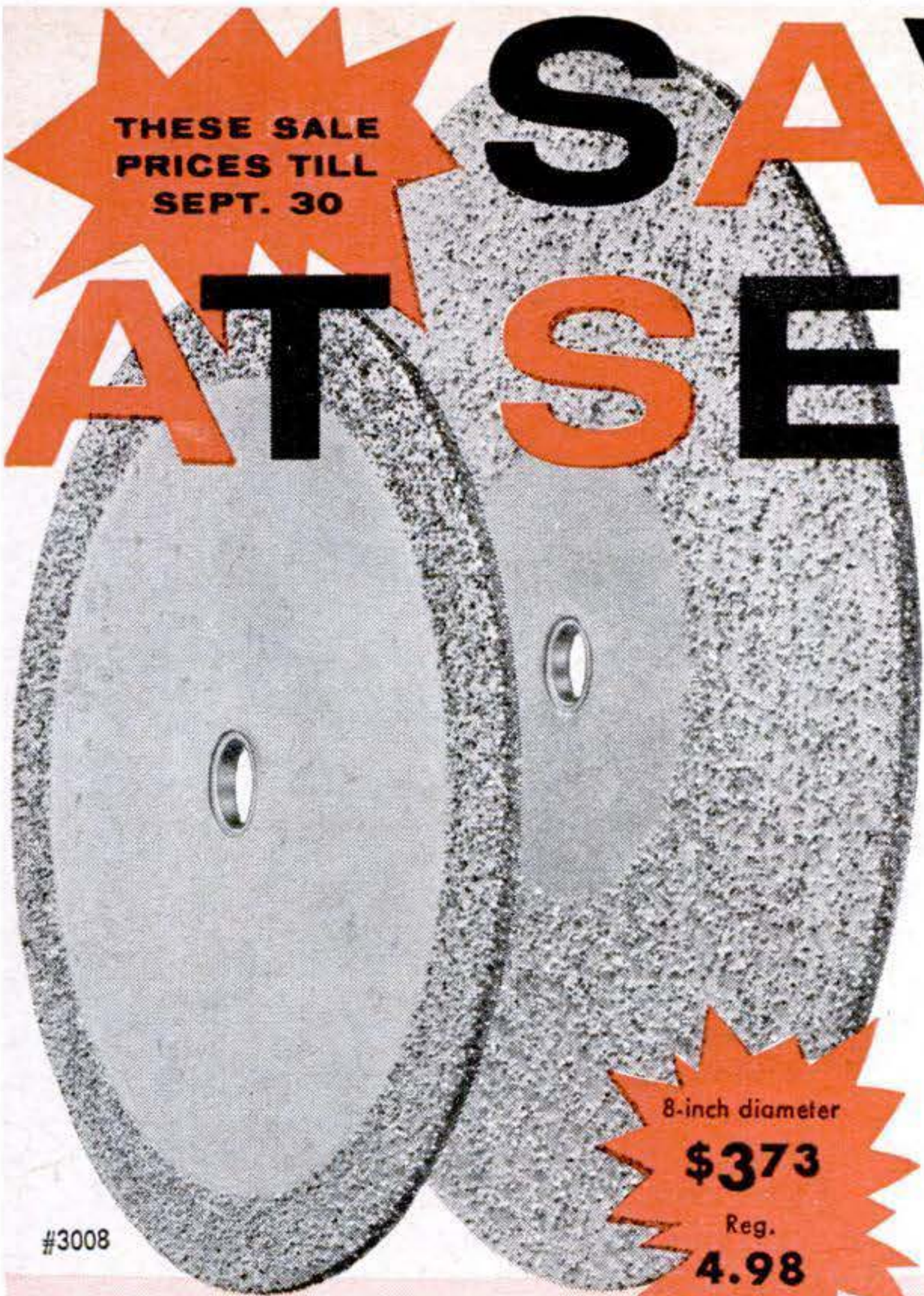

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For rotary motion sanders. Sands twice as fast as sandpaper. Eliminates changing of wornout, torn sandpaper. In fine, medium or coarse. #3007.

6-inch diameter.....**1.26** Reg. 1.69
Fine, medium or coarse.

Karbo-Grit Rasplane Blade (Half Round) **96¢** Reg. 1.29
Blade has two rows of razor-sharp cutting edges set at a 35° angle. Smooths wood with grain or against it. Fits #6770-71 file.
Flat. #3016.....**96¢** Reg. 1.29

Karbo-Grit Sanding Sheet, 73¢ Reg. 98¢
3 x 8 inches. Fine, medium or coarse #3017
3⅝ x 9 inches.....**1.11** Reg. 1.49 #3018
4½ x 11 inches.....**1.48** Reg. 1.98 #3019

Karbo-Grit Hand Sander, 1.11 Reg. 1.49
Outlasts hundreds of sandpaper sheets. 2¾ x 5½-inch platen with felt back-up pad. Fine or medium grit. #3002.

Karbo-Grit Vixen Blade, 1.48 Reg. 1.98
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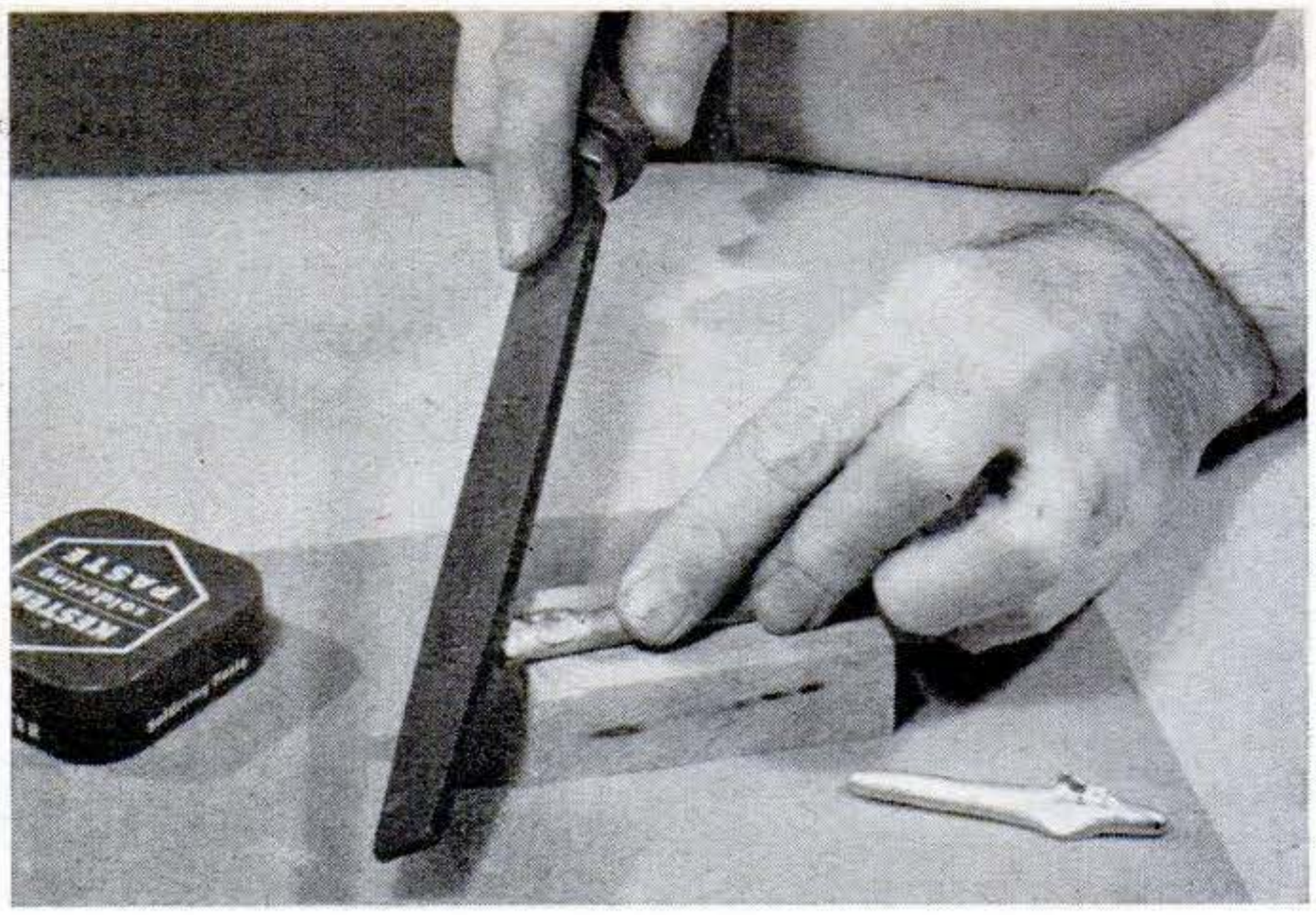
Short Cuts and Tips

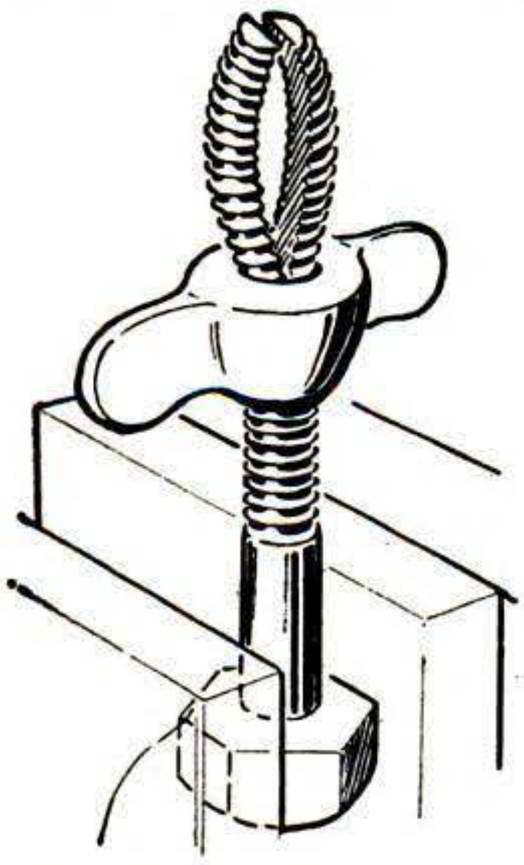
FROM PS READERS

Old Tubes Make Tinning Paste



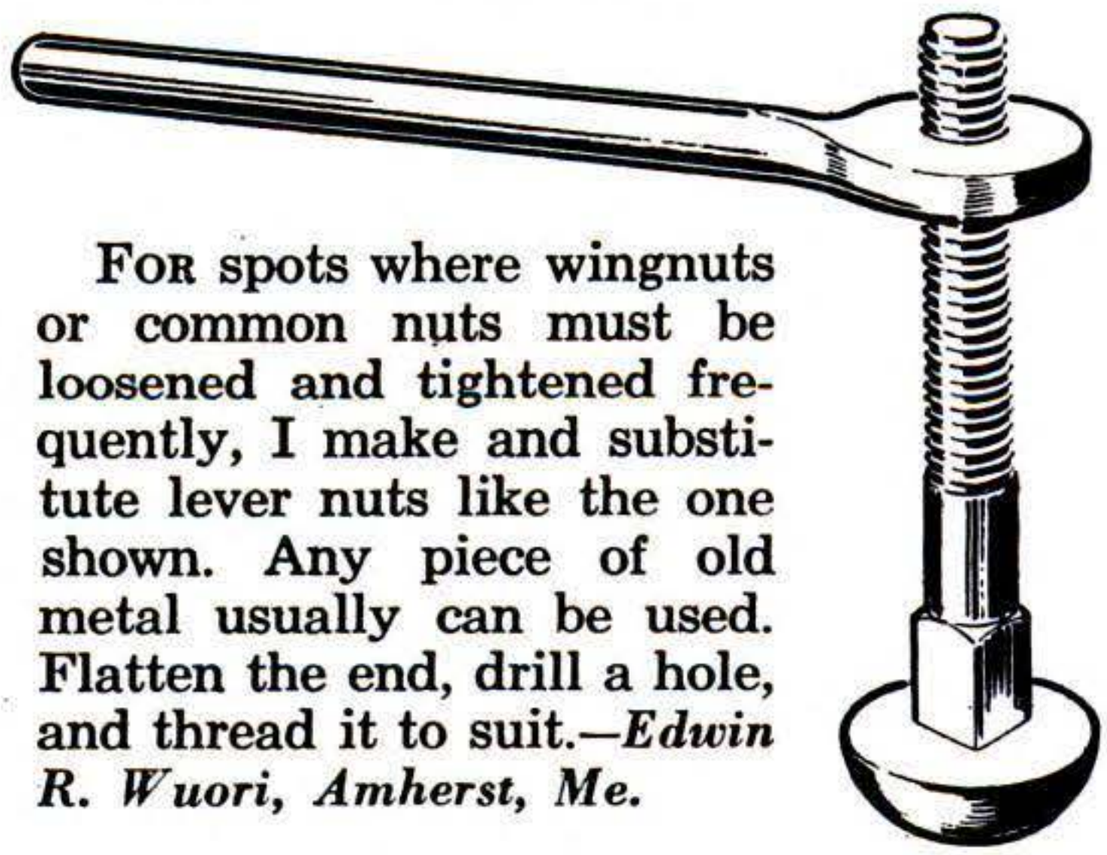
TINNING paste, not always easy to get, can be made in your shop by melting up an empty toothpaste tube. The tubes have a high tin content and work much better than the old trick of shaving ordinary solder. Pour the molten metal into an angle iron or similar trough, to cast it into a bar, and shave it off with a file. Mix the filings with paste-type flux to form a paste and spread it on the part to be tinned.—*Walter E. Burton, Akron, Ohio.*

Pin Vise Made from a Bolt



BY SPLITTING the ends of a long bolt with a hacksaw, you can make an inexpensive vise for holding small parts. Run a wingnut on the bolt, then spread the split ends slightly. Turning the wingnut up or down will quickly tighten or loosen the vise.—*M. R. Beasley, Detroit.*

I Call 'Em Lever Nuts



FOR spots where wingnuts or common nuts must be loosened and tightened frequently, I make and substitute lever nuts like the one shown. Any piece of old metal usually can be used. Flatten the end, drill a hole, and thread it to suit.—*Edwin R. Wuori, Amherst, Me.*

Paint Pail Clings to Roof

A BUCKET of paint or roofing compound won't slip off a sloping roof if you use this trick: Partly fill a large plastic dish cover with sand or loose, dry earth. Now set the bucket in the cover.—*W. C. Wilhite, Carlinville, Ill.*

Cement Shockproofs Wires

POWER cords won't come loose from their plugs if you seal them in with plastic rubber after the screw terminals have been tightened. The rubber sets hard in a few hours and will keep the wires from fraying and shorting.

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[Continued from page 63]

every house for miles around, including the county seat, Machias, pop. 1,621.

All the electricity that flows into the top hat has to get back through the ground. Dirt is a poor conductor, and Maine dirt is worse than most. "We'd copper-plate the whole peninsula if we could afford it," remarked a Navy engineer. What they did comes pretty close. They laid 2,000 *miles* of No. 6 bare copper wire into a screen (every crossing individually brazed) that is buried about a foot below ground. It covers the peninsula and runs down into the ocean on all three sides—seawater is a good conductor.

The monstrous antenna system gets its broadcasting signals off coaxial cables as big as sewer pipes, laid in six-foot underground tunnels. They run to the transmitter house, a concrete pillbox midway between the two antenna arrays.

It resembles a big-city radio station—until you compare sizes. There are four final amplifiers, 500,000 watts each. The vacuum tubes are two feet high. They're installed in duplicate, with the spares always hot and ready to operate. Coils are wound of copper pipe that a plumber could use. And the transformer . . . The one in your TV set fits in your hand. This one looks like a water tank for the roof of an office building.

No sparks. With 2,000,000 watts of low-frequency electricity running around, you might expect the whole station to crackle like an earth-bound thundercloud. Its builders devoutly hope it will not. They handled the top-hat cables, made of bronze alloy an inch and more thick, as though they were fragile glassware. Even a nick $\frac{1}{16}$ inch in the surface would generate a blue-glowing arc, wasting power.

Everywhere there are elaborate precautions. Everything, including the steel reinforcement of concrete buildings, is grounded several times. All buildings are roofed with copper, which is grounded. The helix houses, where the coaxial feed cables are coupled to the antennas, are lined with aluminum, every seam welded. The huge gallery that carries transmitter power from the output transformer to the co-ax is completely lined with copper—floor, walls, ceiling. No combustibles (such as wood or people) are permitted there; they would bake to a crisp.

Still, the engineers expect no special hazards. The Navy has operated similar, if somewhat less powerful, radio stations for many years. Maintenance crews will work in the antenna field while NAA broadcasts. For one thing, 2,000-odd acres of grass must be mowed, since tall growth hinders transmission. The technicians will have to learn the approved technique for getting out of their trucks: You jump off with both feet. Substantial voltage will be induced in steel truck bodies. Anybody who climbs down in the usual way will get knocked flat on his face.

Few people live near the site, and their home activities will not be affected by the superpower transmitter, the Navy says. This reassurance is considered a bit glib by outsiders, who remember the tales of radio witchery told by neighbors of much weaker stations (hearing aids that pick up signals, house lights that can't be turned off).

Signaling through water. The most powerful radio station in the world will put a $100,000,000 bite on U. S. taxpayers. It costs so much because the Navy needs to send messages through water. Nature has made that uncommonly difficult. It's a strange fact that a puny transmitter, emitting a few watts, can signal to earth from a space probe beyond the sun, while 2,000,000 watts are needed to reach a sub submerged off our coast.

Water absorbs radio waves the way smoked glass absorbs light. Long waves (low frequencies) get through more easily than short waves. Besides, long waves give wide and reliable coverage, spreading over the surface of the earth (NAA will also handle messages for surface ships and shore stations). Unlike short waves, they do not have to bounce back and forth off charged layers in the atmosphere, often messed up by sunspots.

That's why NAA broadcasts the longest practical waves (6 to 20 miles). Still longer waves would be better, but would require an impossibly high antenna. The new station is an economic compromise, bolstering the water-penetrating ability of its wavelength with tremendous power.

Even NAA, for all its costly power and wavelength, can send signals only about 30 feet deep into the ocean. Talking to submarines is expensive.

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What torque really means

When grandfather cranked his car, he was applying torque. Torque is simply the twisting effort such as you apply when turning a door-knob.

Grandfather applied torque by pushing down on a crank. (Pulling up was far safer, since it avoided a possible kick-back and a broken arm.) In either case, the torque he generated could have been measured by multiplying the *pounds* of his force on the crank-handle by the length of the crank-arm in feet. Unless grandfather was very husky, his torque probably didn't amount to more than 50 *pounds* times 1 *foot* or 50 *pound-feet.*

Torque is important to you because it, and not horsepower, actually starts your engine and moves your car. Explosive forces on the pistons of your engine are transmitted by the connecting rods to the crankshaft cranks which generate torque on that shaft. But the largest 1960 passenger car engine generates only 470 pound-feet of torque, which is still not enough to move a stationary car. However, the transmission and differential are able to increase engine torque six or seven times. The rear wheels then convert it into powerful traction at the road surface which reacts to propel the car.

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[*Continued from page 116*]

Three techniques work well, either singly or in combination:

1. Work in to a noise source slowly. If you move twice as close to a noise source, the sound reaching your ears becomes four times as loud. Keep your distance until you have had a chance to see whether moderate noise causes ringing in your ears or muffled hearing; then, day by day, move a little closer.

Never put your head up close to the noise source, though. Even moderately noisy machinery can destroy hearing if you do. For instance:

Farmer Harry Jones climbed down from his tractor seat and waved his son up to the controls.

"There's a funny kind of noise in the engine," he said.

Harry put his head down close to one part of the engine after another while his son revved it up. Harry hardly noticed the ringing in his ears as he climbed back into the tractor seat, but in the quiet of the following night it sounded quite loud. To this day the ringing continues. People's voices sound crackling harsh, and Harry can't understand them at all in social groups or in noisy places.

2. Use ear protection. You can cut the sound level with snugly fitted plastic earplugs as much as you would by moving four times as far away from the noise source. Cotton stuffing helps as much as staying twice as far from the noise. Special earmuffs, which employers in noisy industries will usually provide, are highly effective. If you can't keep at a safe distance from noise, constant ear protection may be the best answer.

3. Use less-noisy equipment. One good example of this technique comes from an ear specialist's own experience. When his wife complained about how loud he talked the first day or two after a hunting trip, he did a quick check on his own ears.

"I was knocking my hearing down every weekend," he told me. "But when I tried earplugs I found I couldn't locate birds fast enough—couldn't hear them in the brush."

"What did you do?" I asked.

"Used a little cotton stuffing, and switched to a lighter gun with a vented barrel. I gave up magnum loads, too. Tests show I'm not harming my hearing any more, or I'd quit. Hunting isn't worth that much to me."

What can you do if you already have signs of noise-induced ringing in your ears, or hearing loss? Obviously, the first step is to get a hearing test. If you work in a noisy plant, your company doctor will probably arrange it. If hearing loss seems related to your off-the-job interests, arrange a test through your local hearing society or your local health department.

In many rural areas where special agencies are not available, hearing tests are conducted in the schools once or twice a year. The school people will often arrange a hearing test for you. Or your family doctor will set it up. Few doctors other than ear specialists have the necessary instruments for complete audiometric examination in their own offices.

Heed the signs. Most authorities agree that any substantial hearing loss from noise should lead you to avoid further exposure. This may mean only a slight change in job assignment, proper ear protection, and perhaps a few changes in equipment or procedure. In some cases, you may need to change jobs or hobbies.

If you have substantial hearing loss, you may also want to file a compensation claim. Serious noise-induced hearing loss is covered by workman's-compensation laws in most states, and by federal law.

After you have had a hearing test, stopped further noise exposure, and put in a claim if it seems justified, your next step with noise-induced hearing loss is probably to say a prayer. Some patients make substantial improvement over a period of six months or so; others do not. So far, medical treatment seems to have little influence on the outcome, although research is under way with vitamins B_1 and B_{12} and with several other medications. A hearing aid may help, but is seldom as effective as in other forms of deafness.

Actually, you need never reach that stage from this moment forth. If you recognize the hazard involved in noise, introduce yourself to loud noise gradually, and remain alert to the signs of possible ear damage, you can almost always stop noise-induced hearing loss before it becomes permanent and disabling.

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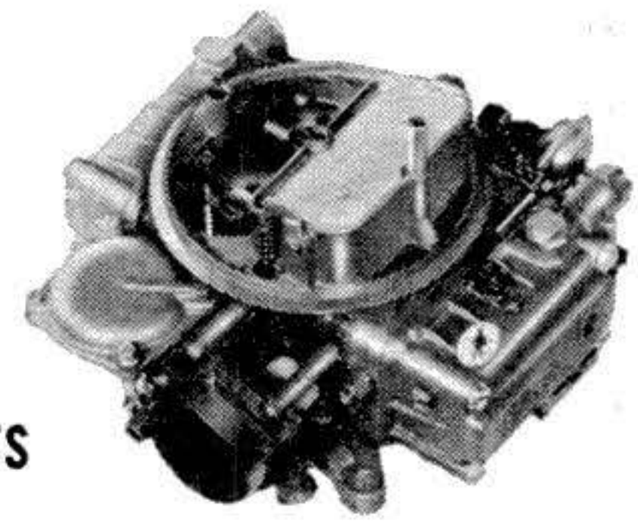

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The Man Who Moves the Earth

[*Continued from page 88*]

Each machine got bigger. An idea haunted him. It reposed in one of those collapsible drinking cups that people took on picnics. The cup was simple. Half-collapsed, it held two inches of water; when full, four inches.

That led to his design of the tandem, two-bucket earth-mover. He filled the lower part of his cup—the rearward bucket—first, hoisted it clear of the ground; and then, with little more exertion, the front bucket. Now he hauled twice as much dirt per trip.

In time the separate tractor disappeared. The power unit became integral with the buckets. Sizes kept going up—bigger buckets, more dirt.

In 1953 one of the country's great corporations came around waving a lot of folding money in his face. He succumbed. He sold out his earth-moving machinery business for $31,000,000. And promptly went back to his drafting board. He had an idea for a new whopper.

Three-corner rig. Oil companies were building offshore platforms—for drilling rigs—by a slow, painful, expensive process of sinking foundations and then putting on superstructures. There had to be a simpler way. LeTourneau designed a triangular platform that floated. On its three corners he attached great steel legs that moved up and down on gears driven by electric motors.

His platform was towed to the drilling site. Down went the legs. They found bottom. As the motors whirred, up went the platform, all 9,000,000 pounds of it, above the reach of waves. Because there were three legs, a touch of a motor switch leveled the platform. "Dry" hole? Just pull up the legs and float the platform to a new location.

Critics snorted. They subsided, though, when the LeTourneau platform was the only one in the Gulf of Mexico, among many in operation, to ride out the 1957 hurricane Audrey with no more damage than loss of paint. Oil companies in Italy and Saudi Arabia are now using LeTourneau three-legged platforms.

The contract with the company that bought out LeTourneau's earth-moving machinery business specified that he couldn't turn a hand to making that sort of thing for five years. For five years—

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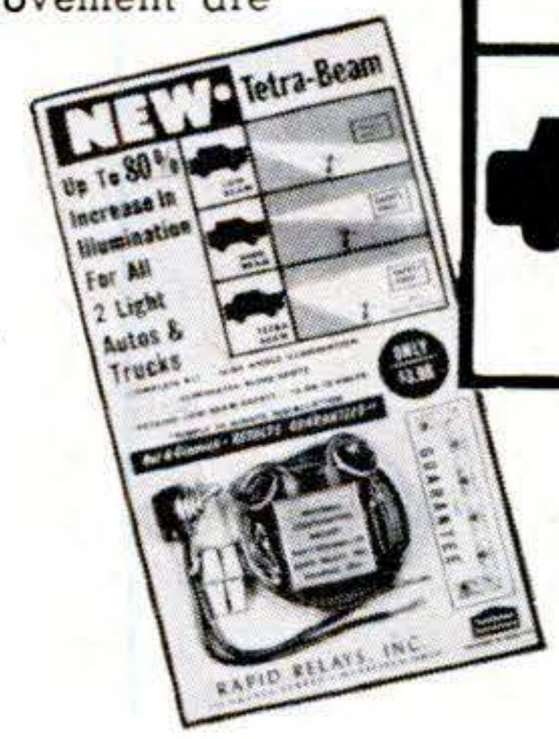

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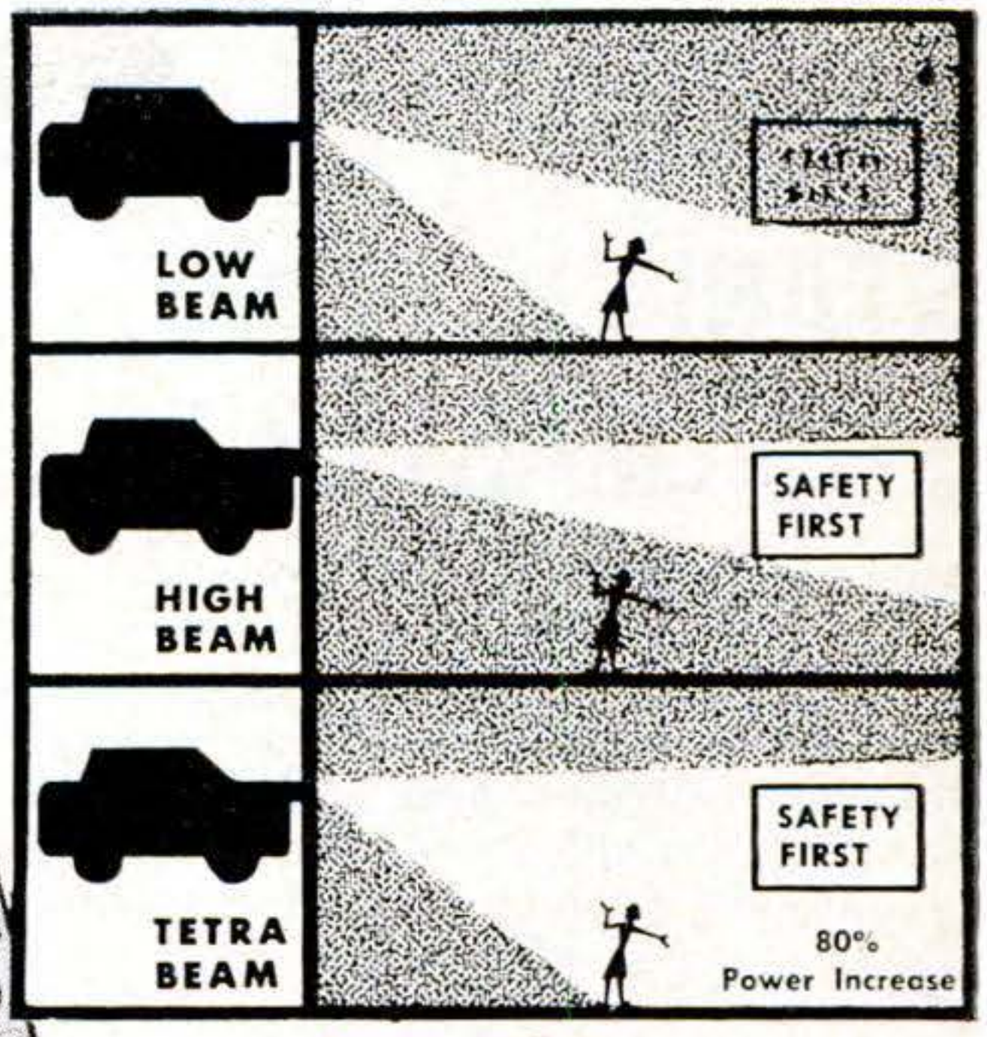

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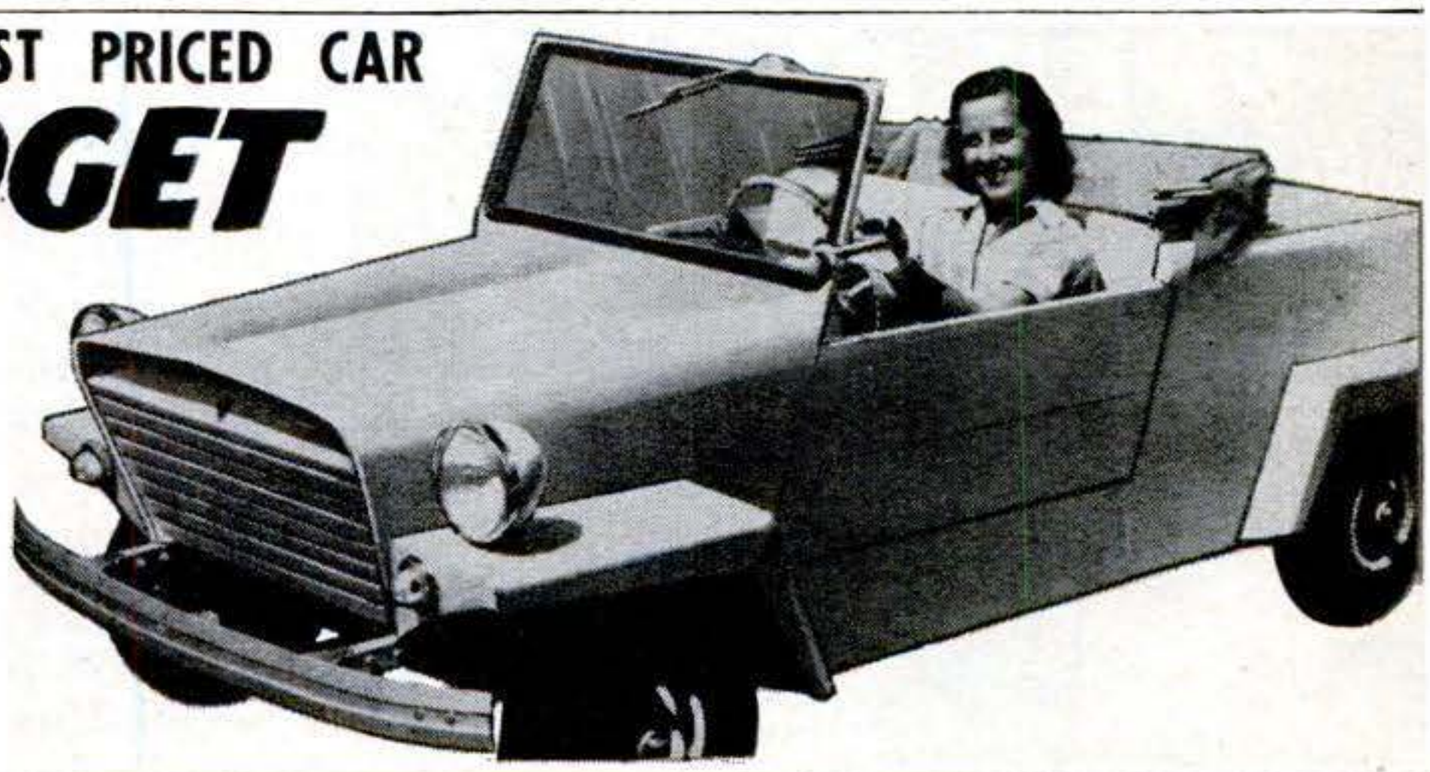

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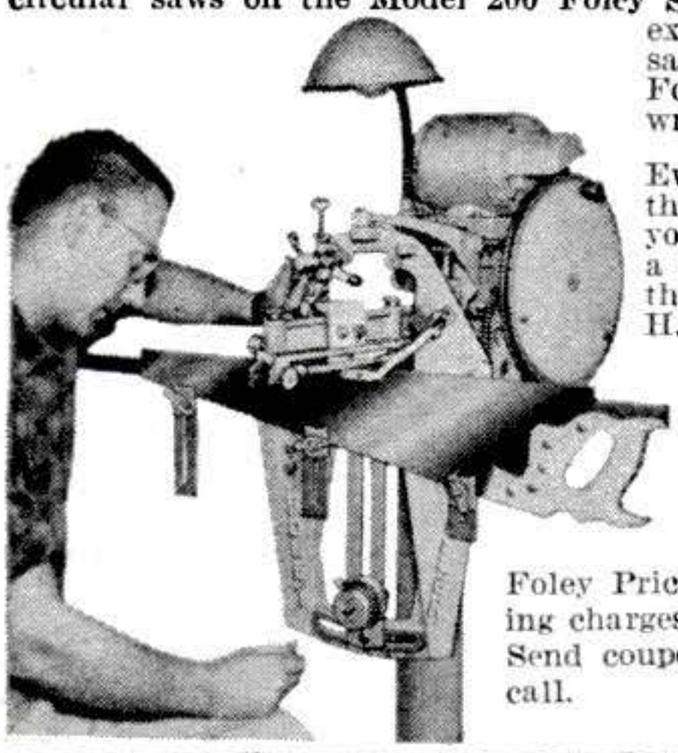

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The Man Who Moves the Earth

and he was 64 years old, an age when most men retire—he fretted, exploding with ideas. In 1958, when the time was up, he came away from his drafting board with still another whopper to apply to his first love—moving dirt.

It was a mammoth electric wheel, a revival of an idea that he had used clear back in 1923. At that time he had adapted the motors from old electric automobiles.

He put eight of his new electric wheels on an earth-moving rig. Each wheel worked. Their efforts were equalized despite differences in traction caused by different footings. The reason: An electric motor, by its nature, draws power in direct proportion to the effort it's called on to exert. Simple, eh? Competitive companies are now adopting the idea.

Charmed life. At 71, LeTourneau is a tall, husky, slightly stooped, and bald man with eyes that miss nothing. He limps a bit, favoring his left leg. He lost half his left hip many years ago in an automobile accident that killed five other persons.

Danger, like that he faced in jumping his car over the ditch, seems to be an abstraction to him. He owns a Volkswagen that he invariably drives with the accelerator flat on the toeboard. He thinks nothing of climbing into one of his private airplanes for an over-ocean trip to Liberia. On one occasion his pilot miscalculated a landing and overturned. LeTourneau crawled out grinning.

He is wholly unaware of his personal appearance. For years his wife Evelyn has bought all his clothes.

"How do you like your new suit?" she asked him not so long ago.

"What new suit?" he responded.

She could only sigh. He had it on.

He says he does his best thinking in an airplane or during his regular Sunday-morning two-hour soak in a hot tub. He used to draw his ideas for new machines with a stick in the dust of his driveway. Now he has more dignity. He draws them on the backs of old envelopes.

The LeTourneaus live in what may be the least pretentious multimillionaire's house in the world. It's an old, converted Army barrack.

Like the first Henry Ford, LeTourneau for years has carried on a running battle with his bookkeeping department. His

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associates, reflecting his attitude, speak darkly of an otherwise unidentified "money man" in the company as though he were the embodiment of the devil. A sharp man with a dollar, LeTourneau nonetheless gleefully spent $15,000,000 on developing his electric wheel—pot-shotting his money man from the ramparts of his office at every opportunity.

He abhors restraints. Under government contract on a special project, he calls the room in his plant where he has to confer periodically with fussy, exacting Army officers the "little Pentagon."

He spends most of his time away from his office, roving among his engineers or racing through the various buildings of his plant in an electric golf cart. It's just as well. His office is poorly lighted and about the size of a hall bedroom.

Apart from his work and his family, his chief passions are the LeTourneau Technical Institute—located, along with a big ranch growing blooded cattle, on his vast Longview acreage—and the LeTourneau Foundation. The institute schools young men who display an imaginative—and preferably simple—approach to engineering problems. The foundation, of charitable and religious complexion, owns 90 percent of the LeTourneau company and absorbs an equal proportion of his personal income.

The LeTourneau enterprises are family-run. His four sons are all executives of R. G. LeTourneau, Inc., or of LeTourneau del Peru.

Still thinking big. LeTourneau is now engaged on a new job, that special one for the Army. It's a rubber-tired overland "train" for the Arctic, a successor to one he built years ago [PS, July '55]. It will be 560 feet long, with 13 "cars" having a total of 54 electric wheels.

LeTourneau loves to encourage the fiction that he is just an aw-shucks, uneducated country boy. This may well be a private joke behind that lively eye.

Writing to Henry Kaiser recently, he penned a postscript in his own hand: "The boys tell me you are realy going to town there in Honolulu."

"Don't you want to put another 'l' in 'really'?" asked his secretary.

"Oh, let it go," said LeTourneau. "Maybe Henry can't spell any better than I do."

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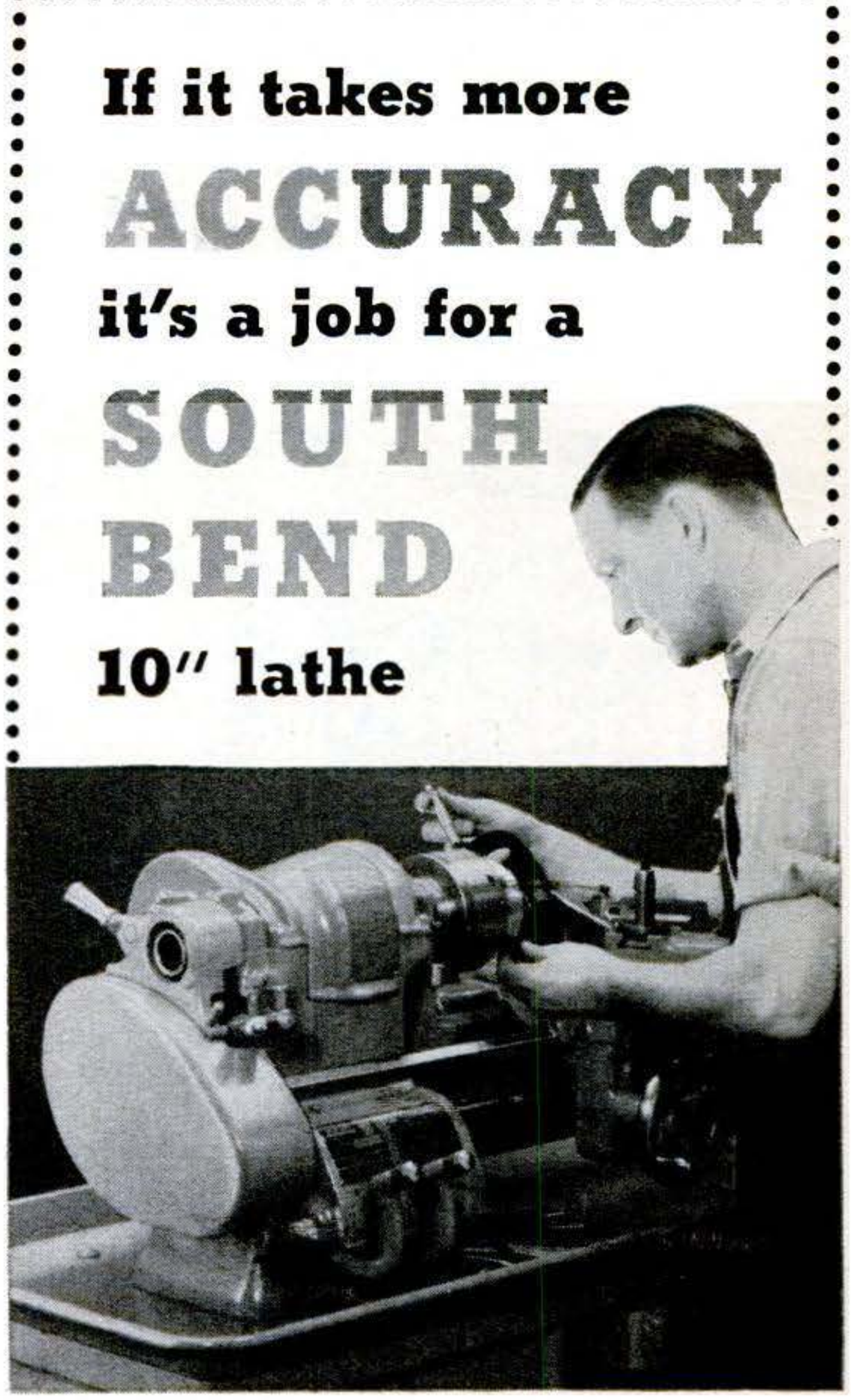

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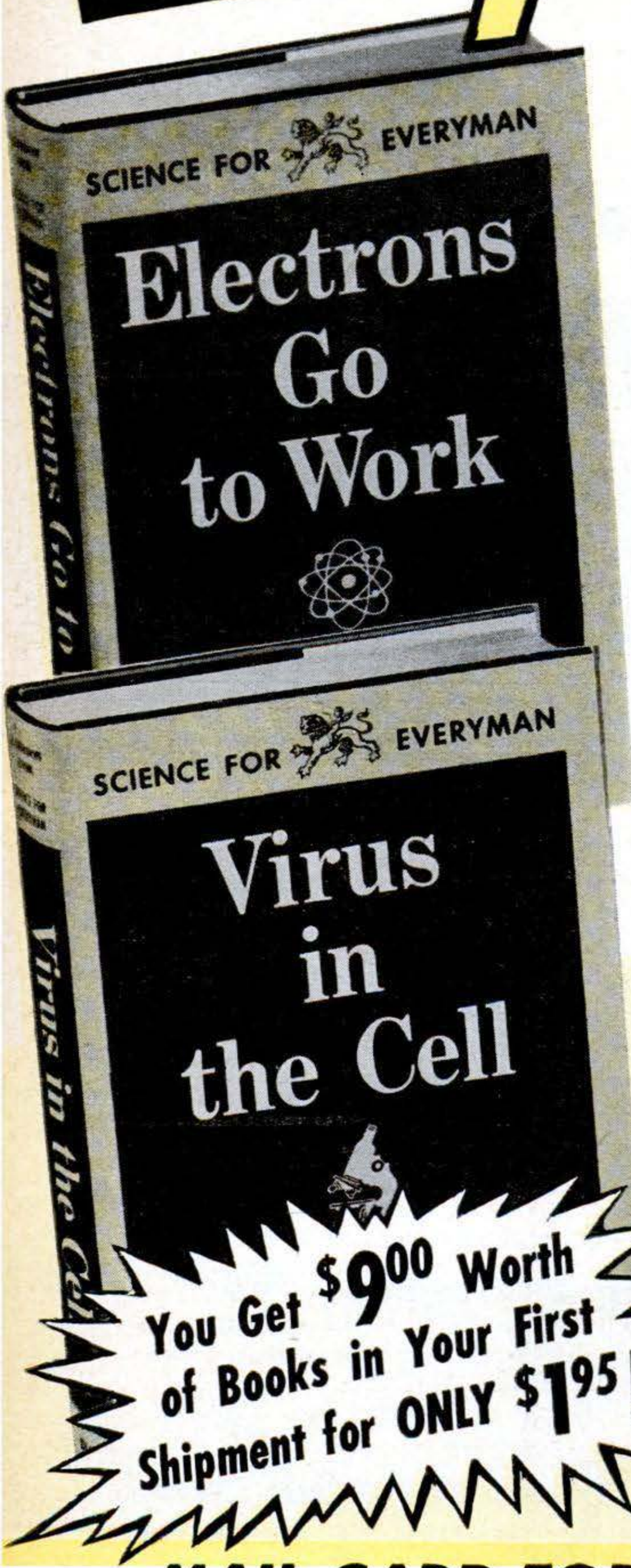

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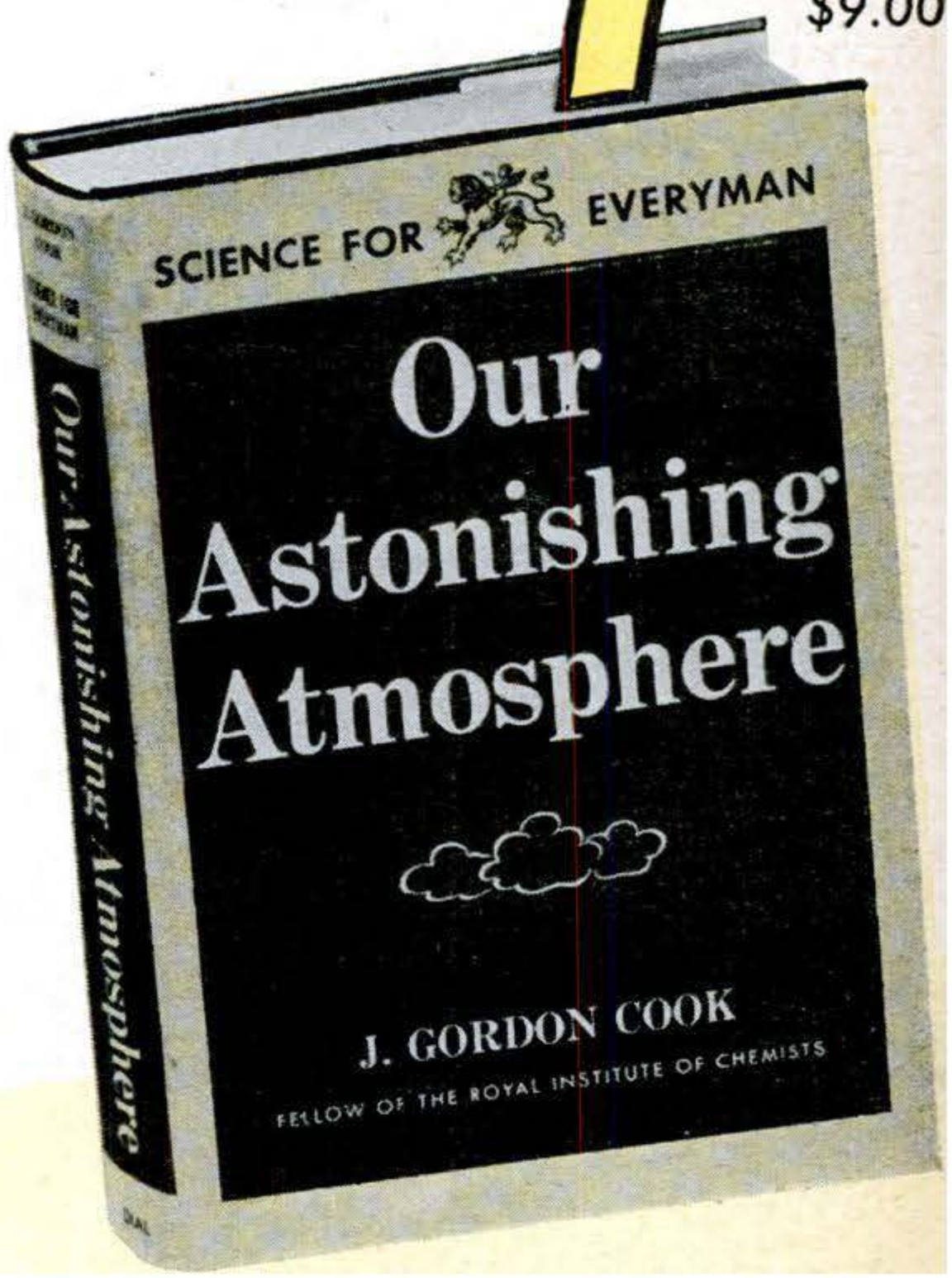

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Planes for Parking-Lot Takeoff

[*Continued from page 81*]

seated between them. He uses vanes in the ducts to deflect the air flow for maneuvering.

This development isn't regarded with universal enthusiasm. One aeronautical engineer in Los Angeles, thinking about the Flying Jeep as he looked out his window at the car-choked freeway, said, "God help us all if autos ever take to the air!"

Ryan's high-tailed Vertiplane is another contender. Its turboprop engine, inside the fuselage, is hooked to two three-bladed propellers, set in under-wing pods. Neither the props nor the wing can be tilted. Instead, when the Vertiplane's pilot wants to fly vertically or hover, he lets down enormous double flaps from the trailing edge of the wing.

The pilot can use wing spoilers for roll control even in up-and-down flying, but depends on thrust deflectors at the tailpipe to deal with pitch and yaw.

The Vertiplane hasn't yet proven itself fully, and has been handicapped by unlucky mishaps.

It may seem odd in the jet age that the leading VTOL candidates are all propeller-driven. The reason: For low-speed takeoffs, a propeller moves more efficiently than a jet.

"I'm reasonably confident that you'll see propellers on VTOLs for some time to come," predicts John W. Hopkins, engineer-manager of the VTOL program at Convair San Diego.

Yet, for the very high speeds that fighting planes need, VTOLs must use jet engines. First to produce a pure-jet VTOL was Ryan. The spectacularly successful Vertijet takes off and lands with its nose straight up, climbing and descending on a column of exhaust. It has made more than 70 transitional flights—more than all other VTOLs together.

The Vertijet is subsonic, red-lined at 400 m.p.h., but it climbs faster than a homesick angel. Pete Girard, Ryan's chief test pilot, insists that if a Vertijet and a 1,400-m.p.h. F-104 were to start from the same ground point simultaneously, the Vertijet would be 10,000 feet in the air before the F-104 got off the runway.

Ryan envisions a supersonic version of its Vertijet that could be stabled in

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inverted silos, and shot out like rockets when duty called.

Bell Aircraft's pure-jet VTOL is the X-14. Built for the Air Force, it has already proved out in flight tests. This little research plane, with two jet engines providing 3,500-pound thrust, is a forerunner of VTOL airliners.

It gets vertical lift by deflecting its jet exhaust, turning it straight down with metal vanes that resemble Venetian blinds. During this flight maneuver, the pilot controls pitch by rotating a compressed-air nozzle in the tail, and governs roll and yaw with two more at the wing tips. To move forward, he closes the engine blinds and flies the plane with normal controls.

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How to save money when you buy a new car

The Vertifan, a fascinating high-speed VTOL, is being dreamed up jointly by Ryan and General Electric. It will team up new, lightweight jet engines with horizontal fans sunk in the plane's wings. The fans are to be powered by tip turbines spun by engine exhaust. At takeoff, vanes covering the fan ducts will open and the slip stream will flow straight downward, providing lift. To move forward, the pilot will slant the upper vanes forward and the lower ones aft, deflecting the slip stream more and more until the plane is going fast enough for normal flight. Then he will close the vanes entirely, leaving the wing surface smooth, and valves will redirect the exhaust flow out the tailpipes.

Some firms are toying with eerie ground-effect machines [PS, July '59], which ride a few inches above ground or water on a cushion of air. There is sharp disagreement among aeronautical engineers, though, about their practicality.

There are a lot more VTOL plans simmering, stimulated by an Air Force design competition for a Mach 2 VTOL fighter. Most of the big U. S. aircraft builders are believed to have been in the contest. But it's still too early for them to be free to talk about their plans.

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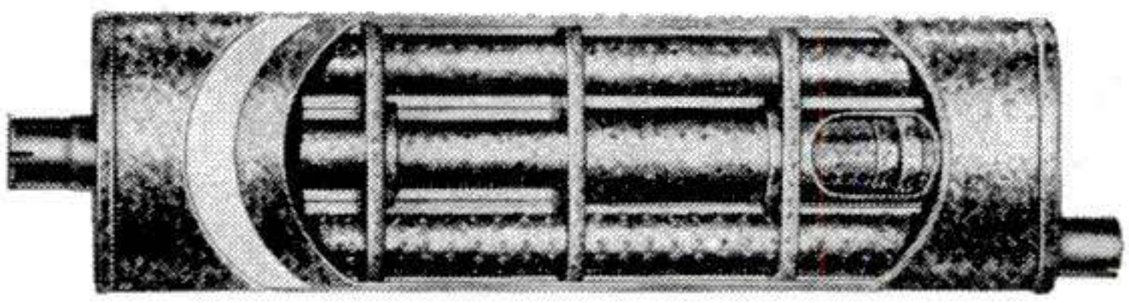

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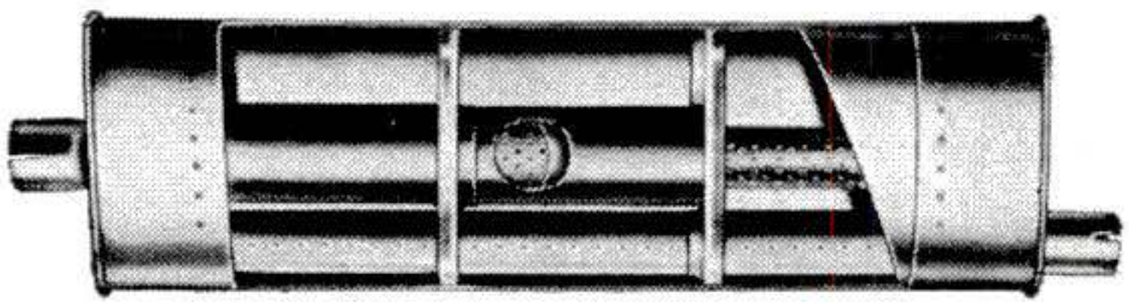

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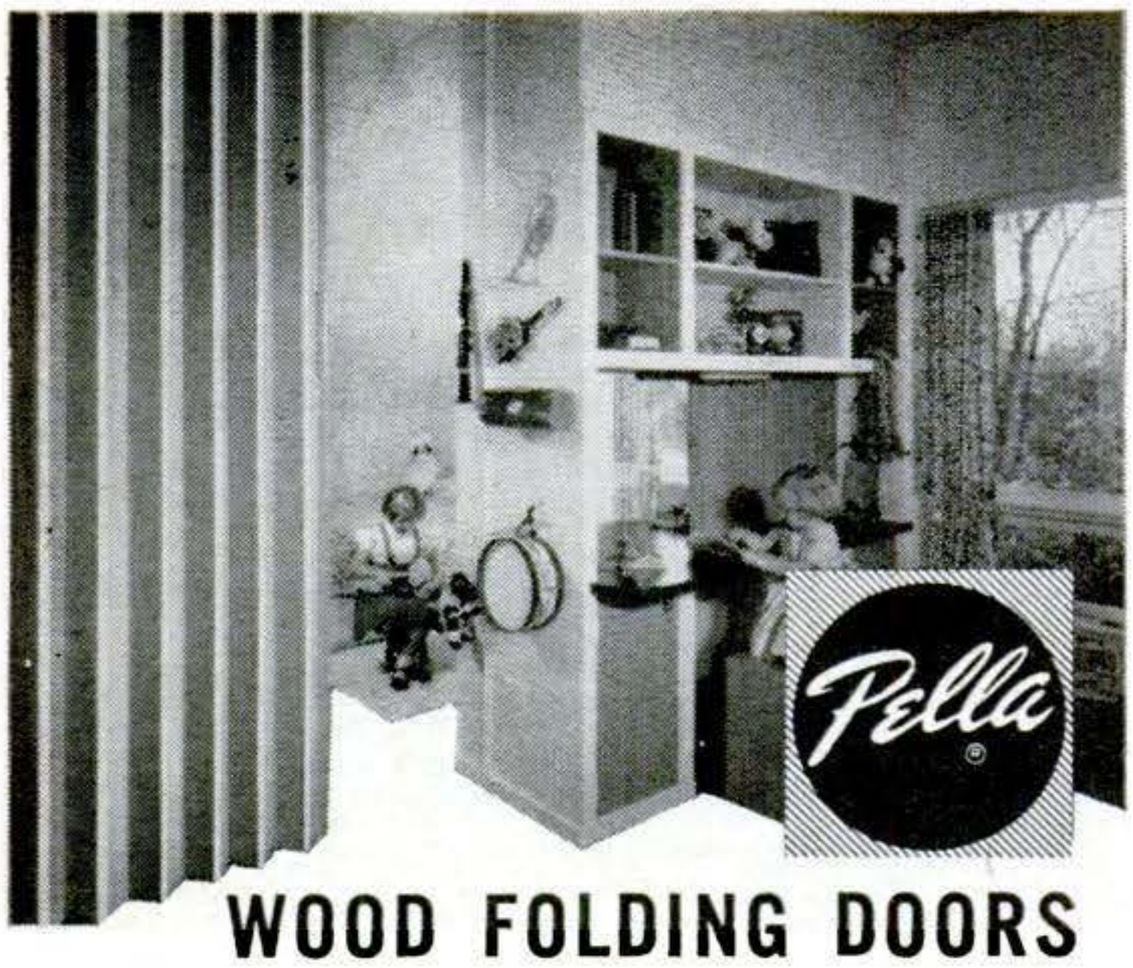

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New Tools Probe Man's Past

[Continued from page 99]

into them the direction of magnetic north peculiar to their spot on the globe at the time they were fired.

If the objects haven't been moved since (a safe "if" for kilns and hearths; less so for pottery), the old direction can be checked by a magnetometer and matched against present data.

Records of magnetic directional changes have been kept since 1540. For earlier periods archaeologists scale their time charts by referring to objects of known age.

Earth's weakening field. While studying this residual magnetism, Oxford scientists have become tantalized by another time clue: the *strength* of the magnetic fields imprisoned in old objects. Strangely, the earth's field is getting weaker. It's five percent weaker today than in 1830, a startling 50 percent weaker than in the second century A.D. (This incidentally explains why there is still so much old magnetism left to study. Again nature seems curiously on the side of the scientists.)

Dating by fire. While the Oxford group charts its backward calendar, researchers at the University of California's Institute of Geophysics are experimenting with another amazing dating technique by "thermoluminescence."

The trick here is to burn a tiny portion of an object with a crystalline structure. (Anything glass, clay, or ceramic will do.) Then watch how long and how brightly it glows. The older it is, the longer have specks of radioactive elements in it had a chance to kick out electrons. While the object is cold the electrons are trapped inside. But reheating sets them free and produces a glow on top of the ordinary glow of a red-hot object.

So far the method has scored very well when tested against objects of known age: Greek pottery from ninth-century (B.C.) Athens, and Mexican ceramics from the sixth and twelfth centuries A.D.

What's it made of? But knowing an object's age tells only half the story. The other half is analysis. Modern archaeology relies on spectroscopy, a non-destructive way of getting an object to reveal its contents by the kinds of rays—X, gamma, or even visible light—it pro-

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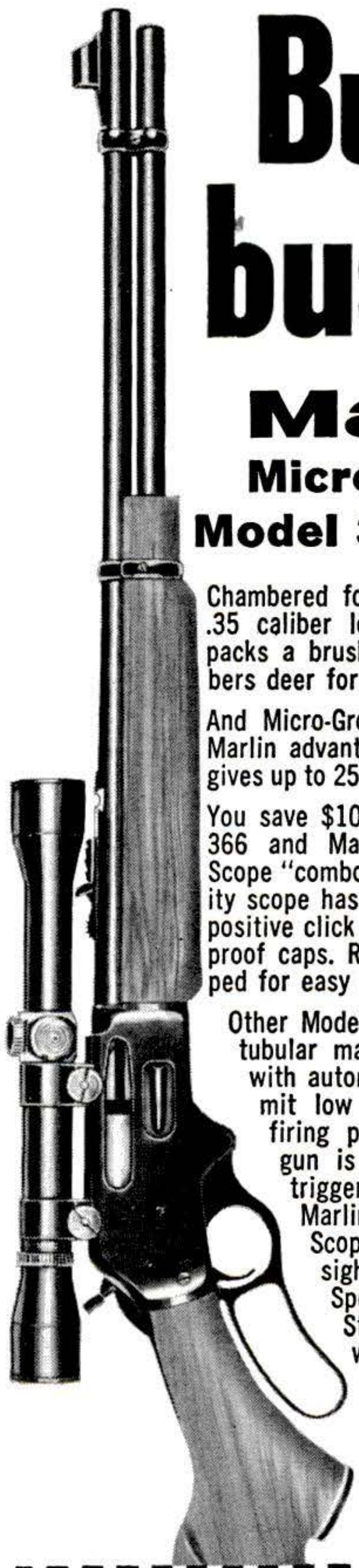
duces when its atoms are excited. The method is particularly effective in archaeology because it can track down the minute trace elements in objects that otherwise get lumped as clay or glass or ceramic.

Chemists at Brookhaven National Laboratory tried neutron activation on their Mayan pot. They bombarded it with electrons to get both gamma and X rays. Then they read off the energy and decay rates of the rays as ratios of elements present (so much scandium to so much chromium, for example). Comparing pots, they found their sample from a northern Guatemalan city unlike other local ware but very similar to pieces picked up farther south. Thus a geographic link was forged.

Checking an old inflation. The Oxford scientists tried the same trick on coins, with results that neatly jibed with historians' theories. They took fifth-century B.C. silver coins from the Greek colony of Syracuse on Sicily and measured the amounts of copper in them. They were low in the beginning of the century, much higher during the second quarter, then lower again. This clinched the suspicion that the coins were deliberately devalued during a period of financial crisis just before the Syracusan tyrants were thrown out in 461 B.C.

The electron probe. Metallurgists at M.I.T. in search of an even finer spectroscopic tool have come up with the electron microbeam probe. Here the bombarding beam of electrons is no bigger around than a human hair, and focuses on an equally flyspeck-size spot on the sample. The fine beam can pick up the barest traces of elements in layers of paint in a painting or glazes on a pot. The tester knows exactly what layer of the sample core is under analysis at any moment by observing through a microscope.

Besides using it to answer the tricky questions posed by ancient technology—what alloys were used in Bronze Age tools? what glazes in Greek vases?—the probe has already demonstrated its sleuthing possibilities: It confirmed as a fake a Renaissance portrait that had once hung in the Boston Museum of Fine Arts. Analysis showed that the paint contained titanium oxide—a pigment unknown before 1920.



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Answers to PS Puzzlers on 20 and 22

Tug-of-war: Using ">" to mean stronger than, "<" weaker than, we get a pair of inequalities and one equality: 1) $H > B+J$ 2) $H+B-T+J$ and 3) $H+J < T+B$

The first question to decide is who is stronger: Hank or Tom. (Bill and Joe are obviously weak sisters.)

First look at the equality (2) and solve it for B(ill). B's force equals Joe's plus Tom's minus Hank's. Then substitute that in the last inequality: $H+J<T+T+J-H$

This amounts to:

$H < 2T-H$, or $2H < 2T$, and $H < T$.

In other words, Tom is strongest, followed by Hank. Now who's weaker, Bill or Joe? That's easy. Since (2) is an equality and we know Hank is weaker than Tom, then Bill must be stronger than Joe—in order for their forces to balance out.

L.P. record: Catch you? Knowing the formulas for the circumference and area of a circle won't help a bit. The needle travels only 3¼ inches, the distance from the outermost groove to the innermost. It's the record that goes around in circles, not the needle.

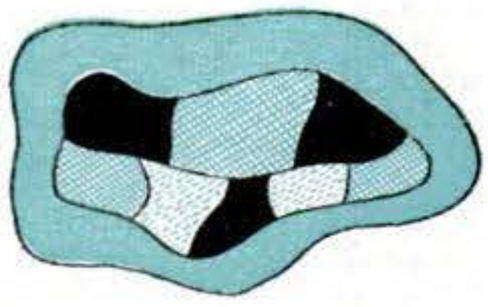
Card sharper: The catch is that the chances are *not* even that the reverse side of the card is either red or white. Here's why. At the start there were six choices: three red, three white. (Either side of each card is equally possible.)

The man chose a card that showed white. It could have come about in three ways: the white side of the red-white card or *either* side of the white-white card.

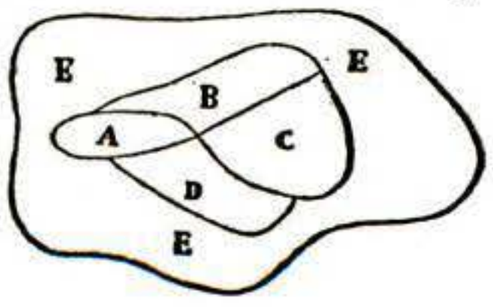
Thus there are three possibilities for the reverse of the card—not two, as the sharper suggests. Look at them. In case 1 the reverse is red. In cases 2 and 3 the reverse is white. Thus the odds favor white 2 to 1. The sharper will stand to pick up 75 cents from the man twice as often as the man will gain a dollar from the sharper. Net loss for the sucker averages 17 cents a game.

The phony bill: All he lost was 10 dollars. You can look at it either as the 10 he had to make up to the druggist, or as three dollars' worth of gloves plus seven dollars' change.

Map coloring: A very simple fix reduces to four the colors needed:



As for drawing the five regions, each bordering all four others, I can't do it, either. But if you cancel the rule prohibiting regions to touch at a point, here's one way it could be done:



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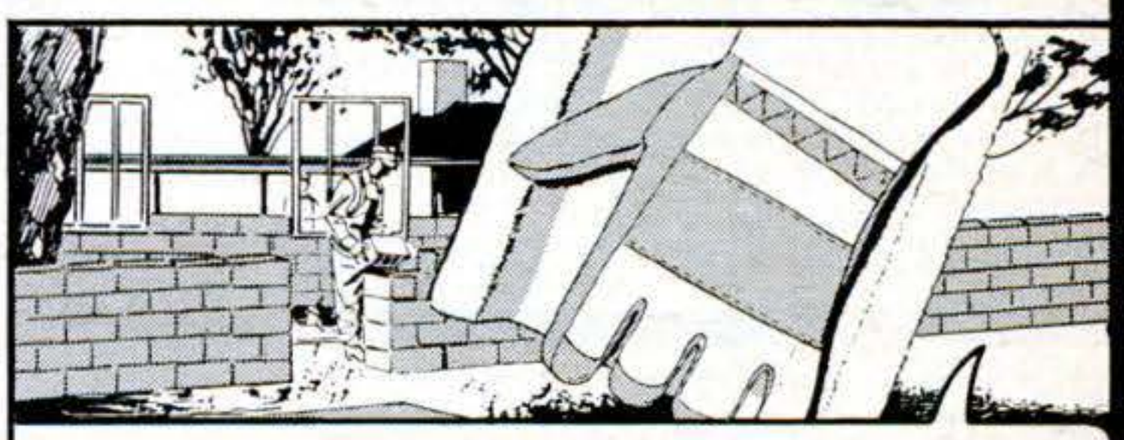

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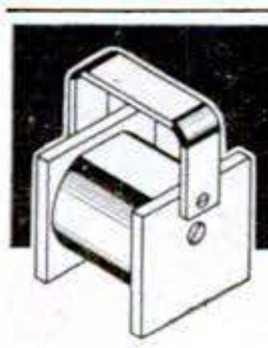

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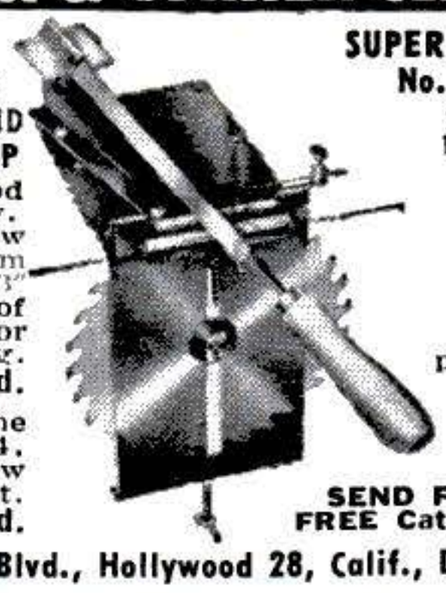

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8100 Florissant • St. Louis 36, Mo.

Tracking the Abominable Snowman

[*Continued from page 69*]

Michael B. Gill, like Hillary a New Zealand mountaineer, with the fastest ascent of Mount Cook (New Zealand) to his credit; George Lowe of Hillary's Everest and Antarctic teams; Peter Mulgrew, another Antarctic veteran; Barry C. Bishop, glaciologist. The expedition's zoologist will be Marlin Perkins, director of Chicago's Lincoln Park zoo. Perkins will attempt to photograph the Snowman by having it trip wires that set off flashbulb cameras.

Black-and-white proof. The most experienced Himalayan mountaineer of them all, Sir Eric Shipton, also will be along. Shipton, in 1951, took close-up photographs of footprints of the Snowman that startled the world and convinced zoologists there really was such an animal. They inspired three expeditions (two American, one British) to hunt the phantom of the snows. None saw a Snowman. The pictures also convinced someone else: Edmund Hillary.

"They made it quite clear," he says, "that some large creature, apparently walking on its two hind legs, had been crossing a glacier at 19,000 feet."

Shipton's photos, plus observations of the tracks, show that the Snowman is itself an expert mountaineer: It can climb or descend a slope with the skill of an Everester. It can leap crevasses. It may be able to speed across the heights far faster than a man.

So Hillary's expedition will pit some of the world's best human Himalayan mountaineers against another champion mountaineer—man-animal, animal-man, or whatever it is—in a chase across the world's rooftop. Hillary starts his trek with an unbiased mind.

"I believe there is sufficient evidence to warrant a closer search for the maker of these tracks," he says. "We are seeking only to find some tracks and then to discover what is making them—bear or Yeti, monkey or man."

Next Month in PS: ***The inside story of political polls. Can they really tell—in advance—who will be elected President of the United States?***

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$3.00 post-paid

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This small bore gun shoots .12 cal. lead bullets fired by small 4.4 mg. powder charge. Not a CO_2 gun! You'll like the handsome lines, grip, and balance. Western in style, but patented ball and cap action allows this low price. 9¾" steel barrel cased in knurled styrene stock, overall 13½". Develop pistol form, accuracy at a fraction of cost of large caliber pistols. Comes with 50 lead bullets. Satisfaction guaranteed. Send $3 to: **HAIG MFG. CO., Box H-30, San Gabriel, Calif.**

See page 266 for Home Improvement Holiday Contest listing of participating Lumber and Hardware dealers and Savings & Loan Associations—page 161 for Contest Entry Blank.

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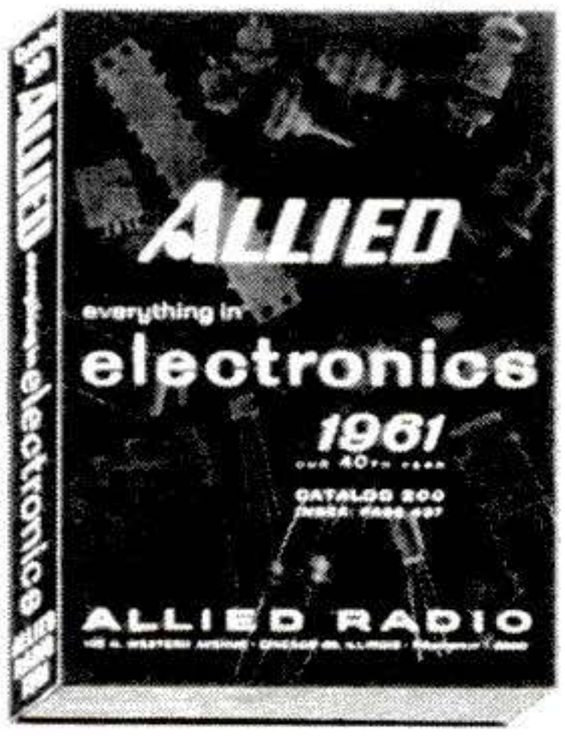

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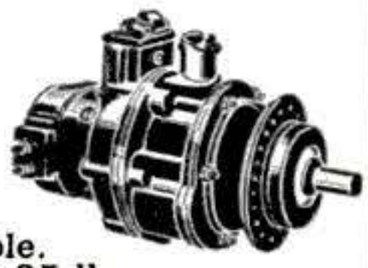

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Getting Rid of Radioactive Rubbish

[*Continued from page 92*]

week. Drums of radioactive waste are trucked to Antioch, not far from the north end of San Francisco Bay. There, 400 at a time, they are loaded on a barge. The drums are laid on their sides in chutes that slant downward from the barge's midline to the water. The Coast Guard drops by to inspect and grant it clearance. A state Board of Health inspector comes aboard for the ride.

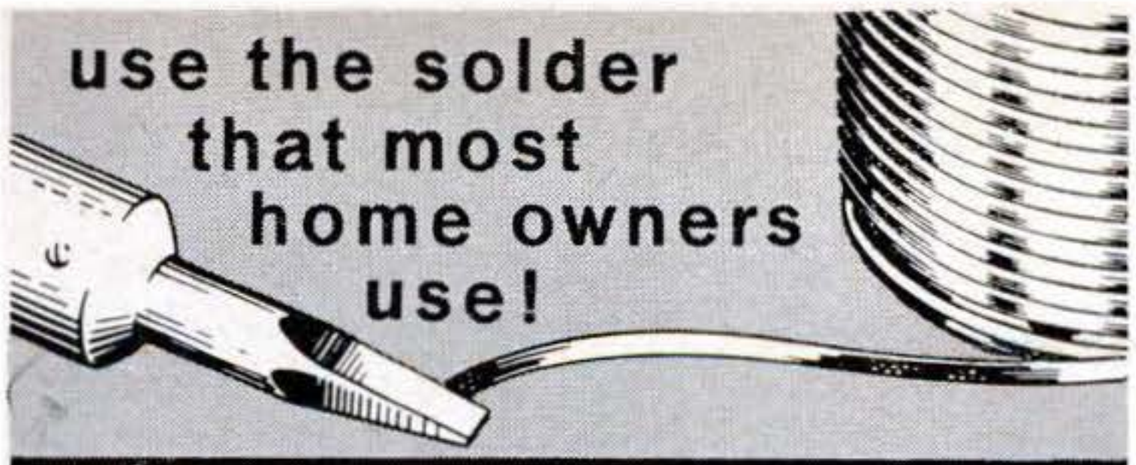
When a calm sea and good weather is predicted, a tug hauls the barge to sea. Sailing time is usually at night. The drums are taken out for burial as secretively as the victims of medieval plagues used to be. But stealth is not intentional. Departures in darkness are scheduled to assure daylight at the destination. It takes 12 hours or more to make the slow journey to the dump, 15-18 miles west of the bird-stained rocks of the bleak Farallon Islands. At the ocean graveyard, men pull topside levers, and gates near the water line fly open to let the drums roll down their chutes and plunge for the bottom, more than a mile below.

This particular atomic dump, the busiest in the Pacific, covers 16 square miles of ocean floor and lies 6,000-8,000 feet below the restless surface. More than 21,000 drums and several hundred concrete boxes of radioactive trash have been sunk there since 1946.

Periodic inspection is given the dump, despite its depth and despite the fact that a good deal of the trash has become harmless before it lands there. In August, for the second time this year, a gray vessel that was once a mine sweeper crawled through those chilly, fog-haunted waters 54 miles west of San Francisco. With a crew of scientific specialists hired by the A.E.C., and a boatload of elaborate gear, it spent several days probing the dump for escaping radiation. It found none. Its crew didn't expect to find any.

Only a year before, bathers at a popular beach in Oregon felt a chill of fear when a steel drum wearing a vivid sign, "Danger—Radioactive Waste—A.E.C.," came bobbing into their midst.

Radiation experts quickly investigated, and found that this was evidently someone's grim joke. The drum had nothing radioactive in it, nor had it ever had.—*Wesley S. Griswold.*



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Alarm Detects Fire Before It Starts

[Continued from page 111]

The uncanny sensitivity of the Pyr-a-Larm can be demonstrated by a simple experiment in a laboratory. A clean-burning match is held momentarily in a glass beaker; then the flame is blown out quickly. When the apparently empty beaker, containing no smoke, is held under a nuclear detector, the alarm sounds almost immediately.

Another graphic demonstration involves overloading an electrical coil. A 110-volt current is passed through a 60-volt relay coil situated 5½ feet below the detector. In just over two minutes, the unit reports the condition.

With any type of thermal detector, no alarm is received, even after a full hour.

Since large fires usually have small beginnings, the value of early detection is obvious. Eighty-nine percent of large-loss fires ($250,000 or over in damage) resulted from delayed alarm, according to the National Fire Protection Association. For churches and schools, the rate is 100 percent. Yet a nuclear system can be installed for a third to a fifth of the cost of a complete sprinkler system.

Nuclear fire detectors are winning wide acceptance in industry. There the cost of "down time" and lost production is often much more than the damage to property, which can be insured. In the realm of personal safety, of course, early warning can mean the difference between catastrophe and a little mild excitement.

The real killer in a blaze is the advance guard of smoke and toxic gases that sweeps ahead of the actual flame. A classic example is the tragic fire in Chicago's Hotel LaSalle in which 61 people died. The county inspection bureau reported that all of the victims of this disaster "died of anoxia and carbon monoxide poisoning. Approximately 80 percent of the bodies were unburned." Yet even this blaze probably started with a discarded live cigarette.

Fires like this are now easily preventable. Nuclear alarms, by detecting fire in the earliest stage, allow ample time for evacuation, as well as for the arrival of trained firemen while the fire is still small and controllable. The devices also prevent needless destruction; to activate a thermal detector or sprinkler, large quantities of materials must be on fire.

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200 AMP D.C. WELDER 24-32 volts D.C., 200 amp gen. Extra heavy duty. Internal fan cooling. Brand new 9 H.P., ball bearing, Briggs & Stratton engine. 200 amp generator (direct coupling to engine). Portable wheeled frame mount. Voltage reg. Rheostat. Reactor coil. Welds ⅛" rod to SAE standard, any thickness metal. Complete. Wt. 200 lbs. NEW. A $750 value. **$199.50.**

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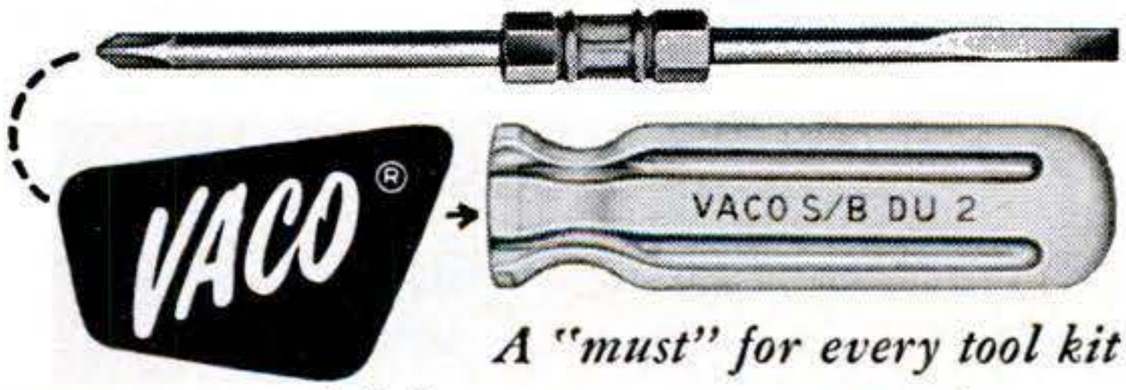

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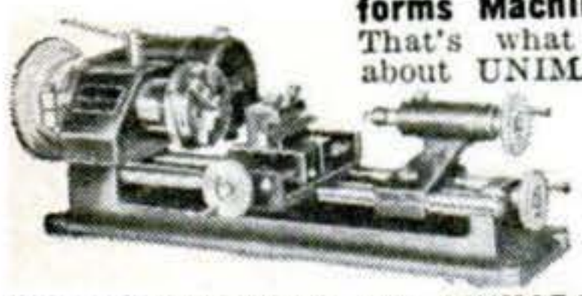

That's what Mechanix Illustrated says about UNIMAT in their 3 page feature story in the May issue. If you want a reprint of this story plus complete information about this amazing 10 in 1 combination precision tool write to:

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Little Batteries Put Power Anywhere

[Continued from page 122]

Spurred by such needs, storage batteries have been advancing along every front—in reliability, higher power, and smaller size. Some types can withstand up to 2,000 charge-discharge cycles. But most important, the best batteries deliver their energy at a uniform rather than a steadily declining rate.

Rapid voltage drop-off doesn't make much difference in a flashlight. But complex electronic gear is far more critical. It needs extra circuitry to compensate for voltage changes.

Thus a known and stable power source makes it possible for designers to create simpler, more efficient, lower-drain equipment. And they're having a field day doing just this. Already they've extended the blessings of portability to applications that range from field radar to TV cameras and electric drills.

Smaller items that have long been portable also benefit. Used as replacements for conventional dry cells (in flashlights, radios, hearing aids, toys), the new batteries can cut operating costs and give the flexibility and convenience of a fresh electrical charge whenever it is needed.

Burglar alarms. Because of their reliability, compact cells are being incorporated into emergency equipment. Burglar and fire alarms may be connected to the house wiring, but because stand-by batteries are built right in, they are proof against deliberate tampering as well as power failure. The batteries are kept in continuous charge by being "floated" across the line.

Cordless living. The most striking near-future applications of battery power don't fit any of these categories. They aim, rather, at filling a need most of us didn't know existed. Radios and lamps now hug the walls of most rooms, not because we want them there, but because that's where the power is. And we're so accustomed to plugging in electric clocks, wall lamps, and other pinup fixtures, that we take dangling cords for granted.

The coming assault on your AC outlet may soon change all that. For compact, high-output, long-lasting, spillproof, and foolproof batteries are here. And self-powered appliances are on the way.

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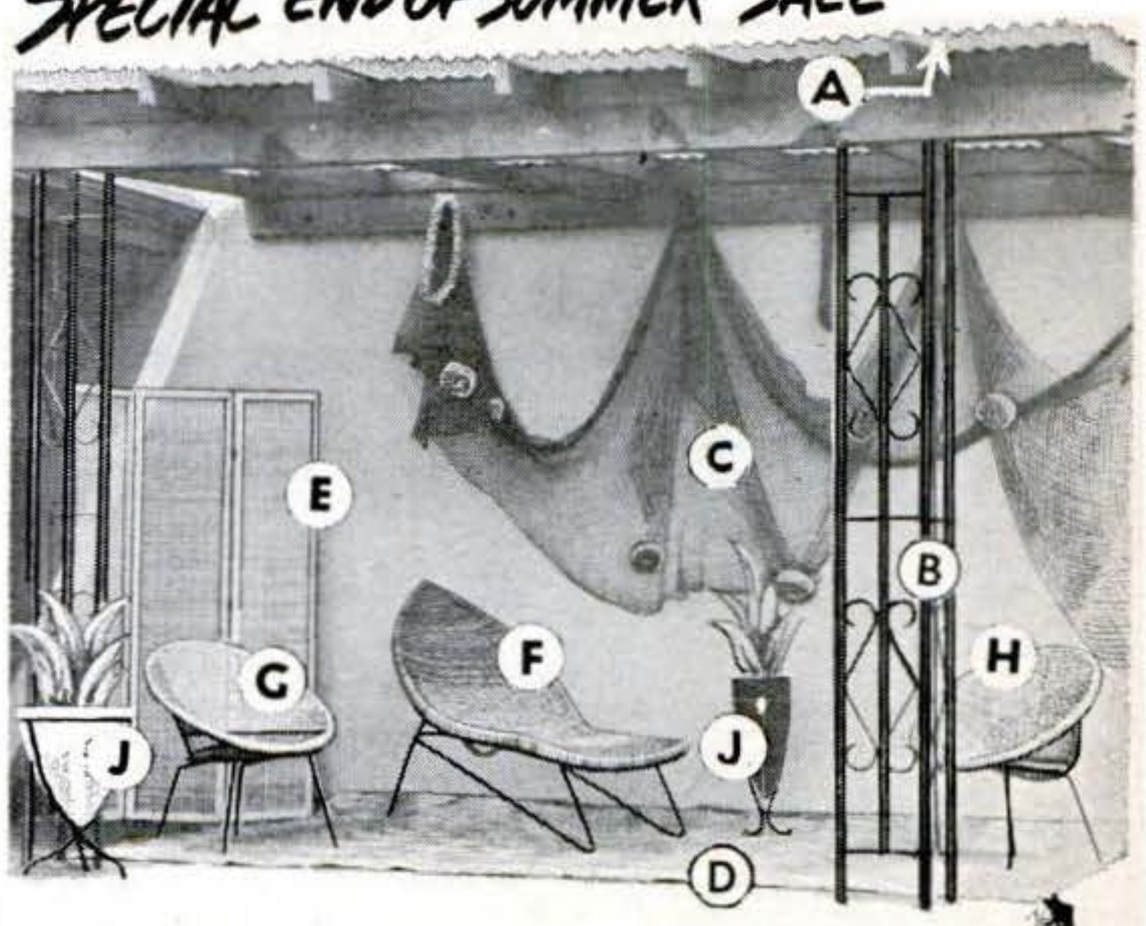

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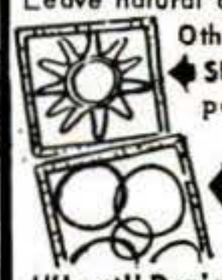

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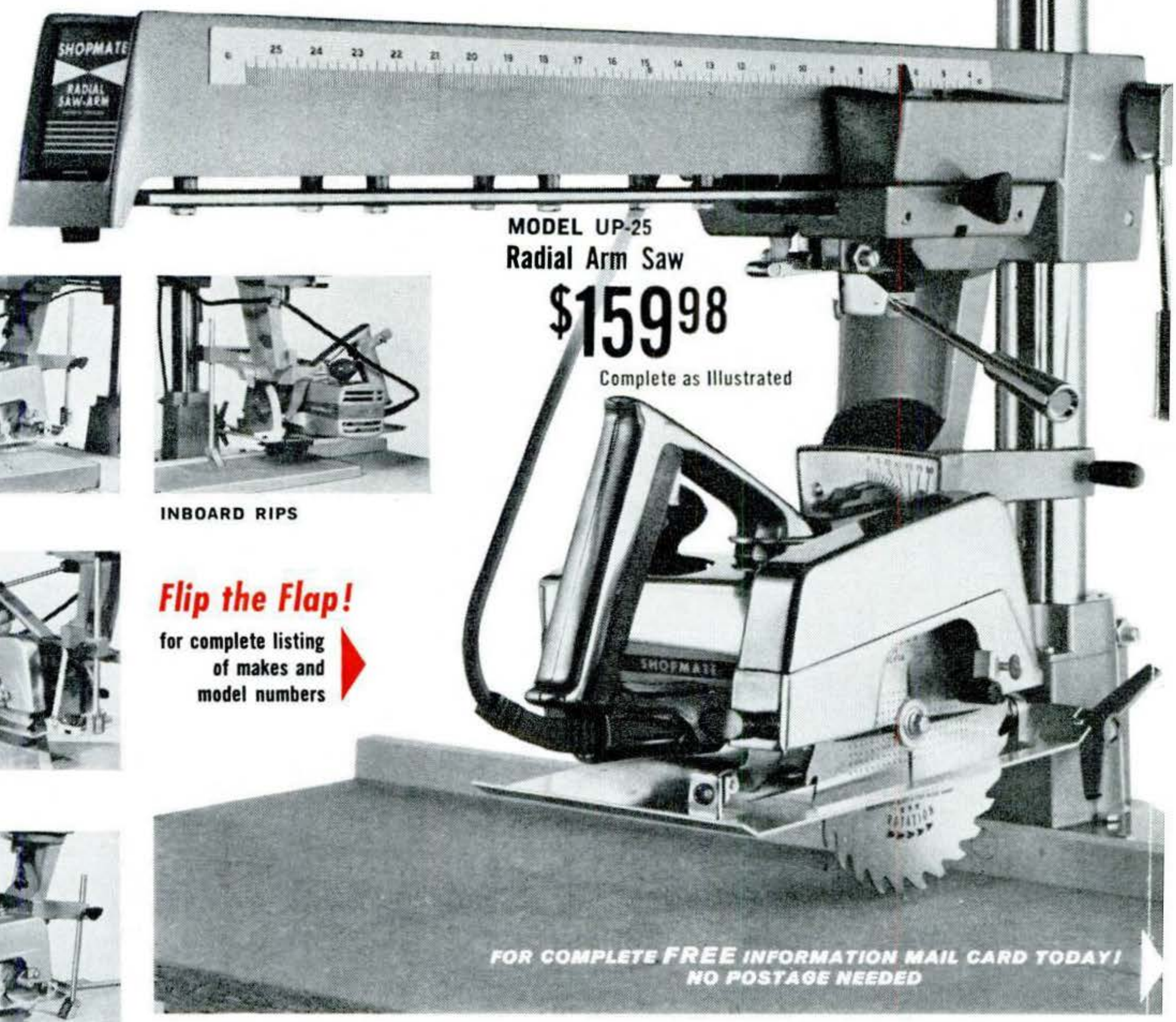

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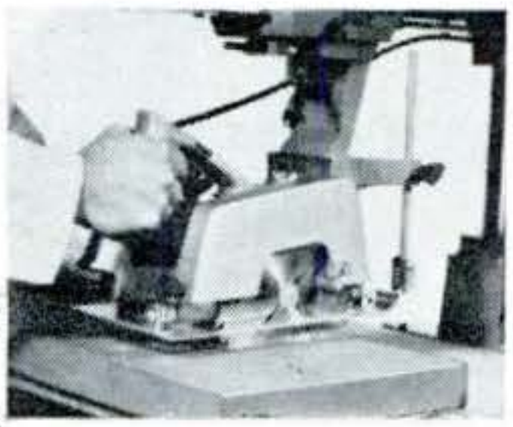

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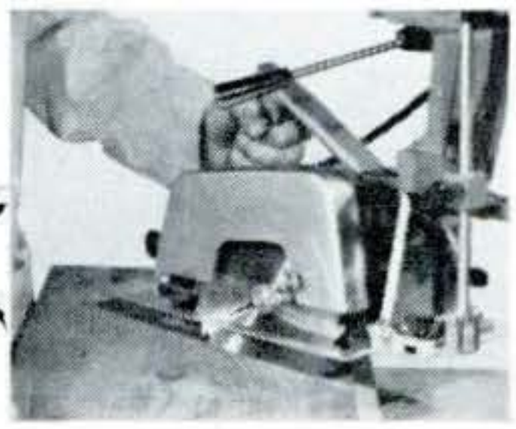

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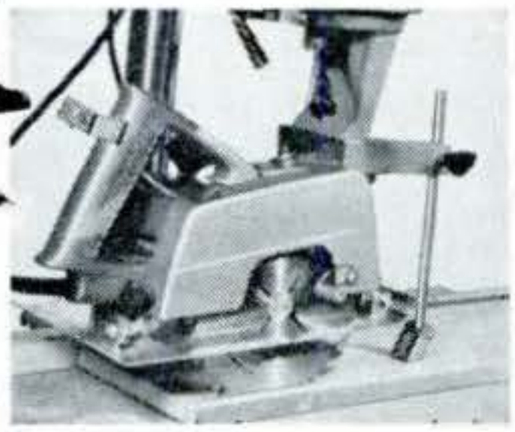

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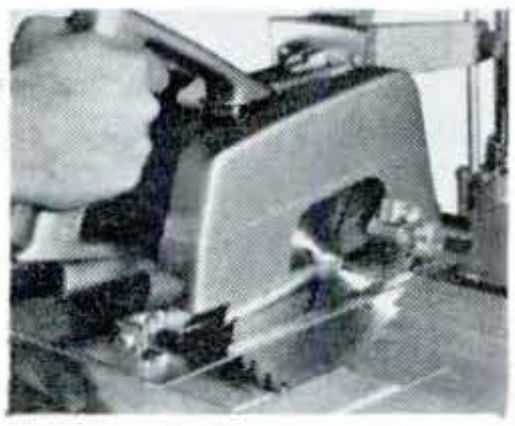

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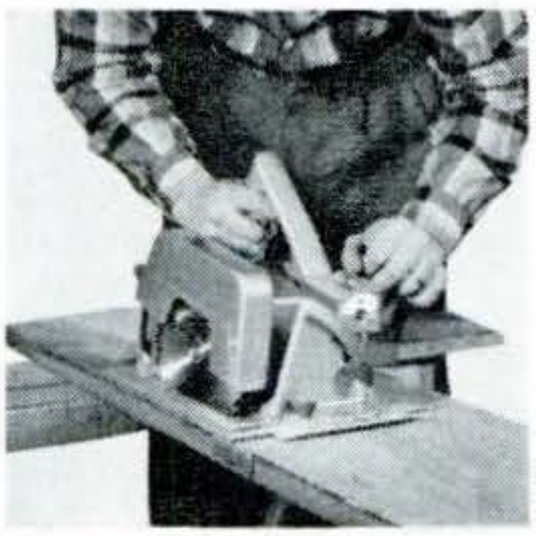

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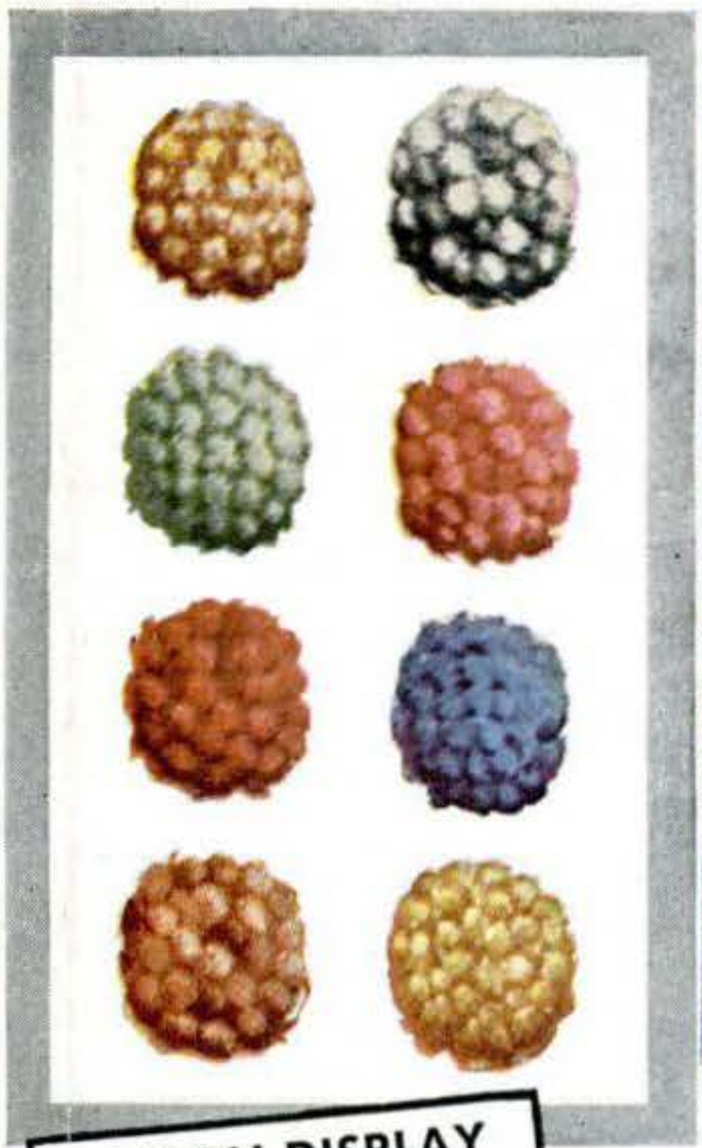

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